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Poor Lighting and Its Excuses for Existence

Large Percentage of Industrial Illumination Characterized as "Accidental"—Reasons Given for Present Conditions—Cost of Good Practice Shown in Relation to Accompanying Shop-Labor Costs

By O. L. JOHNSON and P. A. POWERS

Nearly all of the shops in this United States are "accidentally" lighted. Men who own machine shops will, most of them, find just that kind of lighting right on their own premises. Accidental? Yes. It got there just about that way and without much consideration of the beneficial or other results which would follow. It accidentally lights some places pretty well—some, perhaps, which would be helped by utter darkness—while there are many regular places needing illumination and not getting it.

Less than one shop in four in the past 5 years has had changes made for the better in its lighting system. Investigators tell us that it is 25%, to be exact. Think of that in connection with the fact that the lamps one can buy for industrial use have radically changed in character during that time. If your shop is one of the 16% completely equipped with reflectors no doubt your lighting was pretty good with the vacuum lamps which were installed 5 years ago. But what about using those reflectors with the type C or gas-filled

Day View in Plant of Read Machine Co. at York, Pa., Showing Installation of R-L-M Reflector Sockets.

R-L-M Reflector Sockets in Plant of Read Machine Co., York, Pa.

lamp of today? If that is being done then you have a form of "accidental" lighting which is running up your costs and depriving a number of human beings of the use of their best eyesight.

Accidental lighting is just "put there," the chief influences in favor of installing it being carelessness, indifference, ignorance and, often, penuriousness. It is born of the idea that lighting is in the "A-4" class—necessary, but not essential. Human inertia, a polite term for laziness, persists in saying that "it is good enough because it doesn't hurt my eyes."

The lighting units in "accidental" lighting were not spaced to get the most out of the investment in equipment, they were not mounted at the height required by good practice, and the size of the lamps was not fixed with the engineer's mathematical exactness. No, indeed, 84% of the shop owners in the United States know better than that. Lamps were spaced as the foreman wanted them, according to the arrangement of equipment, and, perhaps, some of the girls obtained an extra lamp or two. The heights of lamps? Why, of course, that is a matter of individual preference. In this shop we know that each man is the best judge for himself of that. Size of lamps? Well, you understand we have to figure pretty close, and so we must keep down expenses. That is accidental lighting, and there is more of it in existence than any other kind. If, as we are told, one plant in six has good illuminating equipment, that one should be awarded a medal for exercising good business judgment. As for the other vast majority there must be some fitting punishment for those who wantonly waste material, make workmen less efficient, weaken human eyesight, and impair the health of mankind. And, in addition, what shall we say of the poor business man who deliberately increases his costs and tosses away his profits?

It is recorded that more than 70% of manufacturers interviewed on the subject of good illumination reply that they are satisfied with what they have—and what they have is "accidental" lighting. It is a fact that of the 80% of manufacturing establishments which are not fully equipped very few have considerable portions of their plants well illuminated. More than that, nearly one-quarter of these have no reflector equipment. They are using bare lamps! And 20% of the manufacturers of the United States are so indifferent to their own well being that they neither protect the eyes of their employes nor do they care about their own.

Remedy Suggested for Elimination of Accidental Lighting.

This is not altogether a pessimistic story. There is hope, and progress in the correct illumination of shops is taking place. Slowly the torch-bearing exponents of good lighting are conquering the cohorts of darkness, and truth will defeat ignorance, energy will overcome indifference, and the penurious can be convinced by proofs of money saved.

It is to the electrical jobber, the contractor and the lighting salesmen that the manufacturing world and the shop owner must look for guidance in the matter of "What is the proper kind of lighting equipment for me?" "How shall I go about it to obtain the benefits of correct illumination?" For that shop owner who, perchance, reads this article let us construct a positive case in behalf of right lighting for him. What is said will be brief, to the point and stripped of technicalities.

The machine shop is the hub upon which the work of most plants depends, for it is there that such machines as lathes, shapers, planers, drill presses, etc., are operated, and from which comes tools, dies and other parts so essential to manufacturing. It is necessary that the entire plant be correctly illuminated, but it is especially important that the machine shop have light of proper quality and quantity, for the work done here has such a decided effect upon the efficiency of manufacture and the quantity of the product.

There is a difference between light and illumination. This difference must be recognized by all factory executives who desire their machine shops to operate efficiently. Light is a cause and

Night View Showing R-L-M Shade Holder Reflector Over Benches.

illumination is the effect. Illumination, in other words, is properly applied light. It is possible to have plenty or too much light in a room and still not have illumination. The factory executive naturally asks, "How may I know that I do not have proper illumination in my plant?" The answer is easy. You have wrong lighting if there are many indications such as carbon lamps suspended by cords and if you are equipped with dirty, greasy painted cone shades; or as is usually

the case, if there are no shades at all except for the crude and pitiful attempt of workmen to protect their eyes by placing pieces of paper or cartons over the lamps. If you think it is necessary to keep windows clean in order that daylight may enter, then remember it is just as important that lamps and reflectors be washed in order that their light can get to work.

Reflectors are often used with lamps for which they were not designed, and the result is about the same as throwing so much money into the street; for reflectors are designed to take certain lamps, and if not so used can not be expected to provide illumination of the proper quality and so allow the operator to function efficiently.

Another fault frequently noticed is that lighting units are improperly placed, resulting in a nonuniform intensity or level of light, causing too high contrasts and objectionable shadows. Several states have lighting codes, and all of them make it mandatory that such conditions be eliminated.

Properties Essential to the Provision of Good Illumination.

The requirements of correct illumination are no direct glare, no reflected glare, good diffusion, light from the proper direction, proper intensity for horizontal surfaces, proper intensity on vertical surfaces, uniform intensity and sufficient light on walls, posts and ceiling. Glare has frequently been referred to as "light out of place." It is excessive brilliancy within the angle of vision. It is caused by too bright light sources which are not sufficiently covered, and by bright lights against comparatively dark backgrounds. This is one of the chief objections to drop cord or localized lighting.

Reflected glare is the more insidious of the two kinds of glare, because it is not so easily recognized. When light of too high brilliancy is reflected from tools, machines or from any object upon which work is being performed, the result is termed reflected glare. The National Committee for the Prevention of Blindness says that poor sight is caused by bad lighting, eyestrain and glare. The results are found in headaches, nervousness, drowsiness during the day, restlessness at night, indigestion, poor work, unskilled labor and blindness. It is almost inconceivable that any intelligent shop management would allow such

Shallow Bowl Reflector Sockets in Use in "Benjamin" Machine Shop.

Shallow Bowl Reflector Sockets in Use in "Benjamin" Machine Shop.

conditions to exist, and it is high time that steps be taken to correct such errors and prevent their repetition. Dr. DeKayser, a noted optometrist, makes the statement that 50%, or 50,000 of the 100,000 totally blind persons in the United States today would have been saved this terrible affliction if they had not been forced to work under incorrectly applied light.

Diffusion is that quality of light which eliminates sharp objectionable shadows and prevents both direct and reflected glare. In a machine shop this is highly important. Some shadow is necessary in order that perspective be not destroyed, but these shadows must be luminous. It is impossible to work efficiently with the sun shining directly on the machine or work. Diffused daylight of north-sky color quality is best to work by, which accounts for the fact that most skylights face north. It naturally follows that a type of artificial illumination which most closely approaches diffused daylight would enable the operator to work the most efficiently. This gives use to one of the fundamental principles of illumination in machine shops or where work of like character is being done, which is the installation of a large number of small light sources in preference to a small number of large ones. By small light sources we do not mean the 25, 40, 50 and 60-watt sizes, but instead 100, 150, 200 and in some cases those of 300-watt ratings.

The general or overhead system of illumination is the preferable one to use; for with such a system it is much easier to comply with the requirements of correct illumination, one of which is "light from the proper direction." Work can not be done accurately and efficiently when in shadow. Light sources should be installed on symmetrical spacing and a uniform distance above the floor, out of control of the workman.

The intensity of illumination must be uniform and of high enough level, or production will be impeded and material spoiled. For such a condition is the same as blindfolding the workman or forcing him to work in a haze or fog. In a machine shop it is necessary to provide illumination of proper intensity on both horizontal and vertical surfaces. To do this it is advantageous to use a reflector such as the R.L.M. with a bowl-enameled lamp.

In order that there should not exist a contrast

Bowl Reflector Sockets Used in Plant of Benjamin Electric Manufacturing Co., Chicago.

in intensity which is too high, and to present a cheerful appearance of the workroom, the posts, walls and ceilings must be illuminated to an intensity comparable with that on the work.

The benefits of correct illumination include better working and living conditions, more order and neatness about the shop, less eyestrain, fatigue, nervousness and headaches, better superintendency and management and greater contentment of workmen. All of these things result in less spoilage due to more accurate workmanship, greater production, decreased cost per unit of output, fewer accidents and larger dividends. The cost of proper lighting equipment is small, as shown by the accompanying data.

TABLE SHOWING COMPARATIVE COST OF GOOD ILLUMINATION.

Correct illumination and labor—Installation and operation (first year).

Constants (assumed)—	
Working hours per day	8.00
Working days per year	300.00
Average lighting hours per day	3.33
Lighting hours per year	1,000.00
Labor cost per hour	$0.50
Labor cost per year (300 days)	$1,200.00
Equipment (first cost)—	
One 150-watt type C lamp for each workman. List	$ 1.55
Benjamin R.L.M. standard dome reflector. List	3.10
Wire, conduit, labor	10.00
Total	$14.65
Operation—	
Interest at 6% on $14.65	$ 0.88
Depreciation at 20% on $13.10	2.62
Cleaning (12 times)	0.60
Lamp renewal (one)	1.55
Energy for year at $0.03 per kw-hr	4.50
Total	$10.15
Summary—	
First cost of material and installation	$14.65
Operation per year	10.15
Total cost, first year	$24.80
Conclusion—	
Labor cost per day	$ 4.00
Illumination cost per day	0.08
Ratio illumination cost to labor cost	2%

Note.—The cost of labor for 9.6 min. per day pays for equipment, its installation and operation for the first year. This short period of time is saved many times by correct illumination.

Illumination is not an expense. It is an investment which pays large dividends. Mediocre light hampers work and poor light permits ordinary work, but correct illumination facilitates work by removing all impediments, enabling the operator to go at his natural gait with a minimum effort and fatigue. Every day that work is performed under inadequate or incorrect illumination the plant owner pays for better illumination in the coin of lower production, more accidents and greater spoilage. It has been well said that when you need a tool in your shop like "Correct Illumination" you pay for it whether you buy it or not.

NOTES FROM BRITAIN ON LIGHTING PROGRESS.

At a meeting of the Illuminating Engineering Society, in London, the committee on electric lamps and lighting appliances stated that considerable progress has been made in the past year; supplies of lamps have notably increased and the output of gas-filled lamps in particular has risen by five to six times. Fittings suitable for use with the smaller gas-filled lamps have also been introduced. Some small gas-filled lamps with opal bulbs were exhibited by the Edison Swan Electric Co., Ltd., and J. S. Dow showed two small 220-volt neon lamps which had been loaned to him by this company. While still in the experimental stage these small neon lamps have some very interesting features. They can be inserted in an ordinary lamp circuit and resemble a small gas-filled lamp in general appearance. The light, however, is not derived from a filament, but from an electrical discharge through rarified neon gas, the light appearing as a soft orange glow. The light from these small lamps is at present feeble, apparently less than 1 cp., but, as they can be made to consume only 5 watts on 220 volts, it is believed that they will prove useful as pilot lights and in other places where only a very small candlepower is needed. In particular, they appear to have promising applications to electric signs, as the lamps can be so made that the "glow" appears in the form of luminous letters of the alphabet. Mr. Dow also exhibited and described a direct-reading "foot-candle meter" of the type familiar in the United States.

Major Adrian Klein demonstrated the latest form of Sheringham daylight. This "artificial-daylight" device achieves its object by the reflection of light from a gas-filled lamp off the inner surface of a large reflector placed above the lamp, which is painted emerald green and ultramarine with a small percentage of red. In the latest apparatus the preparation of this colored surface has been reduced to a standardized form. A special color-medium which is unaffected by the heat of the gas-filled lamp retains its permanence under the action of its light and gives a matte surface as used. The pigment is applied to a surface comprising perforated zinc superimposed over asbestos, and the bolts and nuts which hold this in position are colored red, thus providing the necessary small correcting color element. The apparatus appears to be answering satisfactorily in practice, and new applications in industry are continually being recorded.

The Cuban Telephone & Telegraph Co., Havana, Cuba, is planning to inaugurate regular service over its new cable lines to Key West, Fla., during this month, at which time connection will be established as far north as Washington, D. C. The line is practically completed and initial tests have proved satisfactory. The new enterprise, making telephone connection possible between Cuba and any part of the United States, represents an investment of close to $2,000,000.

Practical Illumination Design Calculations*

Determination of Lamp Sizes Required — Factors Considered in Choice of Proper Reflecting Equipment—Spacing and Mounting Height—Coefficient of Utilization—Typical Examples Worked Out

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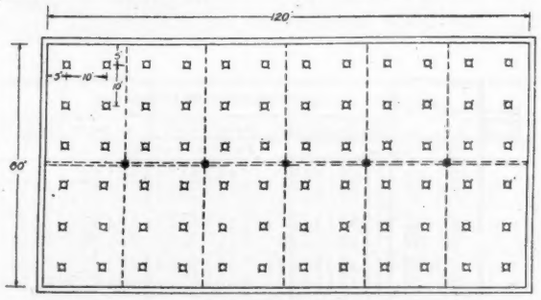
As the first step in design it is necessary to make a diagram to scale of the floor area of the room. If the units are of semi or totally indirect type, measure the ceiling height of the room and refer to the proper table of spacing and mounting height for the permissible spacing of units and preferred suspension distance of lighting units corresponding to this ceiling height.

If the units are of direct lighting type, determine the mounting height and refer to the table for the permissible spacing corresponding to this mounting height. If the units are mounted as close to the ceiling as possible (a minimum allowance of 1 ft. is usually necessary to provide for the drop of the reflector from the ceiling) a wider spacing is permissible and fewer units are therefore necessary for an even distribution of light. Considerations of shadows, appearance and arrangement of work may make a lesser mounting height desirable even though a closer spacing of outlets would be needed to keep the same uniformity of illumination. Ordinarily lamps should not be mounted less than 10 ft. above the floor unless a low ceiling makes it necessary.



Typical Floor Plan, Showing Location and Spacing of Lighting Outlets.

Having determined the permissible spacing, proceed to locate the outlets on the diagram of the floor area. Locate the units as nearly symmetrically as possible without appreciably exceeding the permissible spacing for uniform illumination. At a greater height, a spacing closer than that in the table results in greater freedom from shadows, but increases the number of units required and makes the installation cost more. If a spacing somewhat closer than the permissible value is adopted, as is often the case, it is allowable, though not necessary, to refer back to the table and select a lower mounting height corresponding to the new spacing. The distance between the outside row of outlets and the wall should not exceed one-half the spacing distance. For office spaces, or where work is carried on at benches or machines near the wall, this distance should be approximately one-third the spacing distance.

*Continued from p. 415, Electrical Review, March 12, 1921.

Calculations Required to Determine Proper Lamp Size.

After the outlets have been located on the plan, the lamp size to be used may be determined by the following calculation:

$$\text{Area in sq. ft. per outlet.} = \frac{\text{Total floor area in sq. ft.}}{\text{Number of outlets}}$$

$$\text{Lamp lumens required per sq. ft.} = \frac{\text{Foot-candles} \times \text{depreciation factor}}{\text{Coefficient of utilization}}$$

$$\text{Lamp lumens required per outlet.} = \text{Area in sq. ft. per outlet} \times \text{Lamp lumens required per sq. ft.}$$

Having determined the lamp lumens required per outlet by the above calculations, the wattage of lamps to be used may be found by reference to an accompanying table, which lists the lumen output rating for various lamps. Locate in this table the size of lamp of the desired type which most nearly meets the requirement of lumen output. When the lamp lumens required fall nearly midway between two sizes it is best to choose the larger rather than the smaller, unless it is certain that the less illumination from the smaller will suffice.

Computed Illumination Values Determined and Tabulated.

The foot-candles of illumination in service, allowing a depreciation factor of 1.3, obtained for systems having different coefficients of utilization and areas per lamp have been worked out and are shown in tabular form in this article. These tables can be referred to as an approximate check on design computations made as outlined above.

Choice of Reflecting Equipment Depends on Various Factors.

Various lighting units are rated in accordance with seven fundamentals. The importance of these criteria is different for different classes of work. It must be emphasized that the relative importance of the various criteria should be carefully weighed with respect to the particular problem at hand. For instance, in an office the criteria

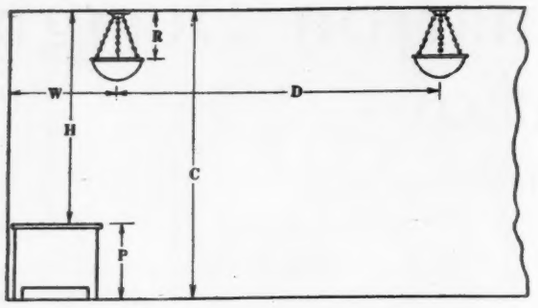


Diagram Showing Use of Indirect and Semi-Indirect Units

would rank in importance: (1) Direct glare; (2) reflected glare; (3) shadows; (4) efficiency based upon illumination on horizontal; (5) maintenance, and (6) vertical illumination. On the other hand, where lamps are to be hung above a crane in a foundry, the order of importance would be: (1) Efficiency based upon illumination on horizontal; (2) vertical illumination; (3) maintenance; (4) shadows; (5) direct glare, and (6) reflected glare.

In the accompanying chart the best rating given is *A*+, which denotes the highest degree of excellence, while *D*, the lowest, indicates that an

SPACING AND MOUNTING HEIGHT FOR SEMI-INDIRECT AND TOTALLY INDIRECT LIGHTING UNITS NO. 22 TO NO. 28.

—Ceiling height.— Above plane of work. (H)	Above floor. (C)	Permissible spacing distance between outlets. (D)	Permissible distance between outlet and sidewalls. In usual locations where aisles and storage are next to wall. (W)	Permissible distance between outlet and sidewalls. In offices or where work benches are next to wall. (W)	Suspension distance ceiling to top of reflectors (R)
5	7½	7½	3½	2½	1¼
6	8½	9	4½	3	1½
7	9½	10½	5	3½	1¾
8	10½	12	6	4	2
9	11½	13½	6½	4½	2¼
10	12½	15	7½	5	2½
11	13½	16½	8	5½	2¾
12	14½	18	9	6	3
13	15½	19½	9½	6½	3¼
14	16½	21	10½	7	3½
15	17½	22½	11	7½	3¾
16	18½	24	12	8	4
18	20½	27	13½	9	4½
21	23½	31½	15½	10½	5¼
24	26½	36	18	12	6
27	29½	40½	20	13½	6¾
30	32½	45	22½	15	7½
35	37½	52½	26	17½	8¾
40	42½	60	30	20	10

installation of units so rated in any particular will very likely prove unsatisfactory in an installation where this factor is important. The ratings *B* and *C* while indicating a result not equal to *A*, are decidedly superior to rating *D*. In other words a rating *B*, *C*+ or *C* in certain respects does not disqualify a unit provided that in the essential requirements of a given location the unit is rated *A* or *B*+.

Illumination on horizontal surfaces is a prime requisite in offices, drafting rooms and those shops where the problem is to provide the best illumination for sustained vision of flat surfaces on the horizontal or slightly oblique planes in which papers, books and other flat objects are usually examined.

Illumination on vertical surfaces of work or machine parts is fully as important as the lighting of the surface in the horizontal plane. In a consideration of the amount of light necessary for factory illumination, the criterion must be the intensity on all working surfaces whether vertical, horizontal or oblique.

Favorable appearance of lighted room refers only to the general or casual effect produced by the complete system and is not intended to rate the unit as to satisfaction from the standpoint of good vision or freedom from eye fatigue.

Direct glare is the most frequent and serious cause of bad lighting. It results among other things from unshaded or inadequately shaded light sources located within the field of vision, or from too great contrast between the bright light source and a dark background or adjacent surfaces. Glare should be avoided by the use of proper reflecting and diffusing equipment.

Reflected glare from polished working surfaces is particularly annoying because of the necessity of directing the eyes toward those surfaces, and further because the eyes are by nature especially sensitive to light rays from below. The harmful effects of this specular reflection can be minimized by properly shielding from below or diffusing the source.

Shadows, that is, differences in brightness of surfaces, are essential in observing objects in their three dimensions, but are of little or no value in the observation of flat surfaces. Where shadows are desirable, they should be soft and luminous, not so sharp and dense as to confuse the object with its shadow.

Maintenance depends upon contour of reflector, construction of fixture and condition of ceiling. The rating is based upon the likelihood of breakage, the labor involved in maintaining the units

Area in Square Ft. per Lamp	Size of Lamp		COEFFICIENT OF UTILIZATION														
			.14	.16	.18	.20	.22	.25	.28	.32	.36	.40	.45	.50	.55	.60	.65	.70
	Watts	Lumens	FOOT-CANDLES														
60	100	1260	2.3	2.6	2.9	3.2	3.6	4.0	4.5	5.2	5.8	6.5	7.3	8.1	8.9	9.7	10.5	11.3
	150	2040	3.7	4.2	4.7	5.2	5.8	6.5	7.3	8.4	9.4	10.5	11.8	13.1	14.4	15.7	17.0	18.3
	200	3100	5.6	6.4	7.2	7.9	8.7	9.9	11.1	12.7	14.3	15.9	17.9	19.9	21.8	23.8	25.8	27.8
	300	4840	8.7	9.9	11.1	12.4	13.6	15.5	17.3	19.8	22.3	24.8	27.9	31.0	34.1	37.2	40.2	43.4
70	100	1260	1.9	2.2	2.5	2.8	3.0	3.4	3.9	4.4	5.0	5.5	6.2	6.9	7.6	8.3	9.0	9.7
	150	2040	3.1	3.6	4.0	4.3	4.9	5.6	6.3	7.2	8.1	9.0	10.1	11.2	12.3	13.4	14.6	15.7
	200	3100	4.8	5.5	6.1	6.8	7.5	8.5	9.5	10.9	12.3	13.6	15.3	17.0	18.7	20.4	22.2	23.8
	300	4840	7.5	8.6	9.6	10.6	11.7	13.3	14.9	17.1	19.2	21.3	23.9	26.6	29.2	31.9	34.6	37.2
80	100	1260	1.7	1.9	2.2	2.4	2.7	3.0	3.4	3.9	4.4	4.8	5.4	6.0	6.7	7.3	7.9	8.5
	150	2040	2.7	3.1	3.5	3.9	4.3	4.9	5.5	6.3	7.0	7.8	8.8	9.8	10.8	11.7	12.7	13.7
	200	3100	4.2	4.8	5.4	6.0	6.6	7.4	8.3	9.5	10.7	11.9	13.4	14.9	16.4	17.9	19.4	20.9
	300	4840	6.5	7.4	8.4	9.3	10.2	11.6	13.0	14.9	16.7	18.6	20.9	23.3	25.5	27.9	30.2	32.5
90	100	1260	1.5	1.7	1.9	2.1	2.4	2.7	3.0	3.4	3.9	4.3	4.8	5.3	5.9	6.5	7.0	7.5
	150	2040	2.4	2.8	3.1	3.5	3.8	4.4	4.9	5.6	6.3	7.0	7.8	8.7	9.6	10.5	11.3	12.2
	200	3100	3.8	4.3	4.8	5.4	5.9	6.7	7.5	8.5	9.5	10.6	11.9	13.2	14.5	15.7	17.1	18.5
	300	4840	5.8	6.6	7.4	8.3	9.1	10.3	11.6	13.2	14.8	16.5	18.4	20.5	22.7	24.9	26.9	28.9
100	100	1260	1.4	1.5	1.7	1.9	2.1	2.4	2.7	3.1	3.5	3.9	4.4	4.8	5.3	5.8	6.3	6.8
	150	2040	2.2	2.5	2.8	3.1	3.4	3.9	4.4	5.0	5.7	6.3	7.1	7.8	8.6	9.4	10.2	11.0
	200	3100	3.3	3.8	4.3	4.8	5.2	5.9	6.7	7.6	8.6	9.5	10.7	11.9	13.1	14.3	15.5	16.7
	300	4840	5.2	5.9	6.7	7.4	8.2	9.3	10.4	11.9	13.4	14.9	16.8	18.8	20.8	22.8	24.8	26.8
110	100	1260	1.2	1.4	1.6	1.8	1.9	2.2	2.5	2.8	3.2	3.5	4.0	4.4	4.8	5.3	5.7	6.2
	150	2040	2.0	2.3	2.6	2.8	3.1	3.5	4.0	4.6	5.1	5.7	6.4	7.1	7.8	8.6	9.3	10.0
	200	3100	3.0	3.5	3.9	4.3	4.8	5.4	6.1	6.9	7.8	8.7	9.8	10.8	11.9	13.0	14.0	15.2
	300	4840	4.7	5.4	6.1	6.8	7.4	8.4	9.5	10.8	12.2	13.5	15.2	16.9	18.6	20.3	22.0	23.7
120	100	1260	1.1	1.3	1.5	1.6	1.8	2.0	2.3	2.6	2.9	3.2	3.6	4.0	4.3	4.9	5.3	5.7
	150	2040	1.8	2.1	2.4	2.6	2.8	3.2	3.7	4.2	4.7	5.2	5.9	6.5	7.2	7.9	8.6	9.3
	200	3100	2.8	3.2	3.6	4.0	4.4	5.0	5.6	6.3	7.1	7.9	8.9	9.9	11.0	12.0	13.0	14.0
	300	4840	4.3	5.0	5.6	6.2	6.8	7.7	8.7	9.9	11.2	12.4	14.0	15.5	17.0	18.6	20.1	21.7
130	100	1260	1.0	1.2	1.3	1.5	1.6	1.9	2.1	2.4	2.7	3.0	3.3	3.7	4.1	4.5	4.8	5.2
	150	2040	1.7	1.9	2.2	2.4	2.6	2.9	3.4	3.9	4.4	4.8	5.4	6.0	6.7	7.2	7.8	8.4
	200	3100	2.6	2.9	3.3	3.7	4.0	4.5	5.1	5.9	6.6	7.4	8.3	9.2	10.1	11.0	11.9	12.8
	300	4840	4.0	4.6	5.1	5.7	6.3	7.1	8.0	9.2	10.4	11.4	12.9	14.3	15.7	17.2	18.6	20.0
140	100	1260	1.0	1.1	1.2	1.4	1.6	1.7	1.9	2.2	2.5	2.8	3.1	3.5	3.8	4.1	4.5	4.8
	150	2040	1.6	1.8	2.0	2.2	2.4	2.8	3.1	3.6	4.0	4.4	4.9	5.4	5.9	6.4	6.9	7.4
	200	3100	2.5	2.8	3.1	3.5	3.8	4.3	4.8	5.5	6.2	6.8	7.7	8.5	9.3	10.2	11.1	11.9
	300	4840	3.7	4.3	4.8	5.3	5.8	6.6	7.4	8.5	9.6	10.6	11.9	13.3	14.6	16.0	17.3	18.6
150	150	2040	1.4	1.6	1.8	2.0	2.2	2.6	2.7	3.1	3.5	3.9	4.4	4.9	5.4	5.9	6.4	6.9
	200	3100	2.1	2.4	2.7	3.0	3.3	3.7	4.2	4.8	5.4	5.9	6.7	7.4	8.2	8.9	9.7	10.5
	300	4840	3.2	3.7	4.2	4.6	5.1	5.8	6.5	7.4	8.3	9.2	10.4	11.5	12.7	13.9	15.0	16.2
	500	8750	5.9	6.7	7.6	8.4	9.2	10.5	11.8	13.4	15.1	16.8	18.9	21.0	23.1	25.2	27.3	29.4
160	150	2040	1.2	1.4	1.6	1.7	1.9	2.2	2.4	2.8	3.1	3.5	3.9	4.4	4.8	5.2	5.6	6.1
	200	3100	1.8	2.1	2.4	2.6	2.9	3.3	3.7	4.2	4.8	5.3	5.9	6.6	7.3	7.9	8.6	9.3
	300	4840	2.8	3.2	3.7	4.1	4.5	5.1	5.8	6.6	7.4	8.3	9.3	10.4	11.4	12.5	13.5	14.6
	500	8750	5.2	6.0	6.7	7.5	8.2	9.3	10.5	12.0	13.3	15.0	16.8	18.7	20.6	22.4	24.3	26.2
180	150	2040	1.1	1.3	1.4	1.6	1.7	2.0	2.2	2.5	2.8	3.1	3.5	3.9	4.3	4.7	5.1	5.5
	200	3100	1.7	1.9	2.1	2.4	2.6	3.0	3.3	3.8	4.3	4.8	5.3	6.0	6.5	7.1	7.7	8.3
	300	4840	2.6	3.0	3.3	3.7	4.1	4.6	5.2	5.9	6.7	7.5	8.4	9.4	10.3	11.2	12.1	13.0
	500	8750	4.7	5.4	6.0	6.7	7.4	8.4	9.4	10.8	12.1	13.5	15.2	16.8	18.6	20.2	21.9	23.6
220	150	2040	1.0	1.1	1.3	1.4	1.6	1.8	2.0	2.3	2.6	2.9	3.2	3.6	3.9	4.3	4.6	5.0
	200	3100	1.5	1.7	1.9	2.2	2.4	2.7	3.0	3.5	3.9	4.3	4.9	5.5	5.9	6.5	7.0	7.5
	300	4840	2.4	2.7	3.0	3.4	3.7	4.2	4.7	5.4	6.1	6.7	7.6	8.5	9.2	10.1	11.0	11.9
	500	8750	4.3	4.9	5.5	6.1	6.7	7.6	8.6	9.8	11.0	12.2	13.8	15.3	16.8	18.4	19.9	21.4
250	200	3100	1.3	1.5	1.7	1.9	2.1	2.4	2.7	3.1	3.4	3.8	4.3	4.8	5.2	5.7	6.2	6.7
	300	4840	2.1	2.4	2.7	3.0	3.3	3.7	4.2	4.8	5.4	6.0	6.7	7.5	8.2	8.9	9.7	10.4
	500	8750	3.8	4.3	4.9	5.5	5.9	6.7	7.5	8.6	9.7	10.8	12.2	13.5	14.8	16.1	17.5	18.8
	750	13900	6.0	6.8	7.7	8.5	9.4	10.7	12.0	13.7	15.4	17.1	19.2	21.4	23.5	25.6	27.8	29.9
280	200	3100	1.2	1.4	1.5	1.7	1.9	2.1	2.4	2.7	3.1	3.4	3.8	4.3	4.7	5.1	5.5	6.0
	300	4840	1.9	2.1	2.4	2.7	2.9	3.3	3.7	4.3	4.8	5.3	6.0	6.7	7.3	8.0	8.6	9.3
	500	8750	3.4	3.8	4.3	4.9	5.3	6.0	6.7	7.7	8.7	9.6	10.8	12.0	13.2	14.4	15.6	16.8
	750	13900	5.3	6.1	6.9	7.6	8.4	9.5	10.7	12.2	13.7	15.2	17.2	19.1	21.0	22.9	24.8	26.7

Tabulation of Computed Values of Illumination.

at comparable degrees of efficiency, and indication given of need of cleaning.

The floor plan of the factory space to be lighted is 60 ft. by 120 ft., as shown in the accompanying diagram, and the work carried on in the room is assembly of sewing machine heads. The height from floor to roof trusses is 12 ft. The roof is of sawtooth construction, and the walls and upper structure are painted a medium color. A considerable amount of dark material is kept stacked along the walls of the room.

Following the steps outlined the lighting design is determined as follows:

(1) *Foot-Candle Illumination.*—From the table showing present standards of illumination it is found that 8 foot-candles are recommended for assembly, medium grade.

(2) *Type of Lighting Unit.*—Consulting the "Guide to the Selection of Reflecting Equipment," unit No. 2, the RLM dome with bowl-enameled lamp is selected, based on efficiency and favorable showing from the standpoints of glare, reflected glare, shadows and maintenance.

(3) *Location of Outlets, Mounting Height and Number of Units.*—The height of the benches, and therefore the plane of work, is 3.5 ft. above the floor. The maximum mounting height of the lamps above the floor is 11 ft. (12 ft. height from floor to truss less 1 ft. allowed for reflector drop). Hence, maximum mounting height of units above plane of work is 11 ft. less 3.5 ft., or 7.5 ft.

From the table of "Spacing-Mounting Height" a 7.5-ft. mounting height above plane for direct lighting units is found to indicate a permissible spacing of approximately 11 ft. and since the section of the room near the walls consists of aisles and storage, 5.5 ft. may be allowed for the distance between the last row of outlets and the side walls.

Area in Square Ft. per Lamp	Size of Lamp		COEFFICIENT OF UTILIZATION														
			.14	.16	.18	.20	.22	.25	.28	.32	.36	.40	.45	.50	.55	.60	.65	.70
	Watts	Lumens	FOOT-CANDLES															
320	200	3100	1.0	1.2	1.3	1.5	1.6	1.9	2.1	2.5	2.7	3.0	3.4	3.7	4.1	4.5	4.9	5.2
	300	4840	1.6	1.9	2.1	2.3	2.5	2.9	3.3	3.7	4.2	4.7	5.2	5.8	6.4	7.0	7.6	8.2
	500	8750	2.9	3.4	3.8	4.2	4.6	5.3	5.9	6.7	7.6	8.4	9.5	10.3	11.4	12.6	13.7	14.7
	750	13900	4.7	5.3	6.0	6.7	7.4	8.4	9.4	10.7	12.0	13.4	15.0	16.7	18.4	20.0	21.7	23.4
360	200	3100	0.9	1.1	1.2	1.3	1.5	1.7	1.9	2.3	2.4	2.7	3.0	3.3	3.6	4.0	4.3	4.6
	300	4840	1.5	1.7	1.9	2.1	2.3	2.6	2.9	3.3	3.8	4.2	4.7	5.2	5.7	6.2	6.7	7.2
	500	8750	2.6	3.0	3.4	3.7	4.1	4.7	5.2	6.0	6.7	7.5	8.4	9.3	10.3	11.2	12.1	13.1
	750	13900	4.2	4.7	5.3	5.9	6.5	7.4	8.3	9.5	10.7	11.9	13.4	14.8	16.3	17.8	19.3	20.8
400	200	3100	0.8	0.9	1.1	1.2	1.3	1.5	1.7	1.9	2.1	2.4	2.7	3.0	3.3	3.6	3.9	4.2
	300	4840	1.3	1.5	1.7	1.9	2.1	2.3	2.6	3.0	3.4	3.8	4.2	4.7	5.1	5.6	6.1	6.5
	500	8750	2.4	2.7	3.0	3.4	3.7	4.2	4.7	5.4	6.1	6.7	7.6	8.4	9.2	10.1	10.9	11.8
	750	13900	3.7	4.1	4.8	5.3	5.9	6.7	7.5	8.6	9.6	10.7	12.0	13.4	14.7	16.0	17.4	18.7
450	200	3100	0.7	0.8	1.0	1.1	1.2	1.3	1.5	1.7	1.9	2.1	2.4	2.6	2.9	3.2	3.5	3.7
	300	4840	1.2	1.3	1.5	1.7	1.8	2.1	2.3	2.6	3.0	3.3	3.7	4.1	4.5	5.0	5.3	5.8
	500	8750	2.1	2.4	2.7	3.0	3.3	3.7	4.2	4.8	5.3	6.0	6.7	7.4	8.2	9.0	9.7	10.5
	750	13900	3.3	3.8	4.3	4.8	5.2	5.9	6.7	7.6	8.5	9.5	10.7	11.9	13	14	15	16.6
500	300	4840	1.0	1.2	1.3	1.5	1.6	1.8	2.1	2.4	2.7	3.0	3.4	3.7	4.1	4.5	4.8	5.2
	500	8750	1.9	2.1	2.4	2.7	3.0	3.4	3.8	4.3	4.8	5.4	6.1	6.7	7.4	8.1	8.7	9.4
	750	13900	3.0	3.4	3.8	4.2	4.7	5.4	6.0	6.8	7.7	8.5	9.6	10.7	11.7	12.8	13.9	15.0
	1000	19300	4.2	4.7	5.3	5.9	6.5	7.4	8.3	9.5	10.7	11.9	13.3	14.8	16.3	17.8	19.3	20.8
600	300	4840	0.9	1.0	1.1	1.2	1.4	1.6	1.7	2.0	2.2	2.5	2.8	3.1	3.4	3.7	4.0	4.3
	500	8750	1.6	1.8	2.0	2.2	2.5	2.8	3.1	3.6	4.0	4.5	5.1	5.6	6.2	6.8	7.3	7.9
	750	13900	2.5	2.8	3.2	3.5	3.9	4.4	5.0	5.7	6.4	7.2	8.0	8.9	9.8	10.7	11.6	12.5
	1000	19300	3.3	4.0	4.5	4.9	5.4	6.2	6.9	7.9	8.9	9.9	11.1	12.4	13.6	14.9	16.1	17.3
700	300	4840	0.7	0.8	1.0	1.1	1.2	1.3	1.5	1.7	1.9	2.1	2.4	2.7	2.9	3.2	3.4	3.7
	500	8750	1.3	1.5	1.7	1.9	2.1	2.4	2.7	3.1	3.5	3.9	4.3	4.8	5.3	5.8	6.3	6.7
	750	13900	2.1	2.4	2.8	3.1	3.4	3.8	4.3	4.9	5.5	6.1	6.9	7.6	8.4	9.2	9.9	10.7
	1000	19300	3.0	3.4	3.8	4.2	4.7	5.3	5.9	6.8	7.6	8.5	9.5	10.6	11.7	12.7	13.8	14.8
800	300	4840	0.6	0.7	0.8	0.9	1.0	1.2	1.3	1.5	1.7	1.9	2.1	2.3	2.6	2.8	3.0	3.3
	500	8750	1.2	1.3	1.5	1.7	1.9	2.1	2.4	2.8	3.2	3.6	4.0	4.4	4.8	5.3	5.7	6.1
	750	13900	1.9	2.1	2.4	2.7	2.9	3.3	3.7	4.3	4.8	5.3	6.0	6.7	7.4	8.0	8.7	9.4
	1000	19300	2.6	3.0	3.3	3.7	4.1	4.6	5.2	5.9	6.7	7.4	8.3	9.3	10.2	11.1	12.0	13.0
900	300	4840	0.6	0.7	0.7	0.8	0.9	1.0	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.5	2.7	2.9
	500	8750	1.0	1.2	1.3	1.5	1.6	1.9	2.1	2.5	2.8	3.2	3.6	4.0	4.4	4.9	5.2	5.7
	750	13900	1.7	1.9	2.1	2.4	2.6	3.0	3.3	3.8	4.3	4.8	5.3	6.0	6.5	7.1	7.7	8.3
	1000	19300	2.3	2.6	3.0	3.3	3.6	4.1	4.6	5.3	5.9	6.6	7.4	8.3	9.1	9.9	10.7	11.5
1000	300	4840	0.5	0.6	0.7	0.7	0.8	0.9	1.0	1.2	1.3	1.5	1.7	1.8	2.0	2.2	2.4	2.6
	500	8750	0.9	1.1	1.2	1.3	1.5	1.7	1.9	2.2	2.5	2.8	3.2	3.5	3.9	4.4	4.8	5.2
	750	13900	1.5	1.7	1.9	2.1	2.4	2.7	3.0	3.4	3.8	4.3	4.8	5.3	5.9	6.4	6.9	7.5
	1000	19300	2.1	2.4	2.7	3.0	3.2	3.7	4.1	4.7	5.3	5.9	6.7	7.4	8.2	8.9	9.6	10.4
1200	300	4840	0.4	0.5	0.6	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.4	1.6	1.7	1.9	2.0	2.2
	500	8750	0.8	0.9	1.0	1.1	1.2	1.4	1.6	1.8	2.0	2.2	2.5	2.8	3.1	3.4	3.6	3.9
	750	13900	1.2	1.4	1.6	1.7	2.0	2.2	2.5	2.8	3.2	3.6	4.0	4.4	4.9	5.3	5.8	6.2
	1000	19300	1.7	2.0	2.2	2.5	2.7	3.1	3.5	4.0	4.5	5.0	5.6	6.2	6.8	7.4	8.0	8.7
1400	300	4840	0.4	0.4	0.5	0.5	0.6	0.7	0.7	0.8	1.0	1.1	1.2	1.3	1.5	1.6	1.7	1.9
	500	8750	0.7	0.8	0.9	1.0	1.1	1.2	1.4	1.6	1.7	1.9	2.2	2.4	2.6	2.9	3.1	3.4
	750	13900	1.1	1.2	1.4	1.5	1.7	1.9	2.1	2.4	2.8	3.1	3.5	3.8	4.2	4.6	5.0	5.3
	1000	19300	1.5	1.7	1.9	2.1	2.3	2.6	3.0	3.4	3.8	4.2	4.8	5.3	5.8	6.4	6.9	7.4
1600	300	4840	0.3	0.3	0.4	0.5	0.5	0.6	0.7	0.7	0.8	0.9	1.0	1.2	1.3	1.4	1.5	1.6
	500	8750	0.6	0.7	0.8	0.8	0.9	1.1	1.2	1.3	1.5	1.7	1.9	2.1	2.3	2.5	2.7	2.9
	750	13900	0.9	1.1	1.2	1.4	1.5	1.7	1.9	2.1	2.4	2.7	3.0	3.3	3.7	4.0	4.4	4.7
	1000	19300	1.3	1.5	1.7	1.9	2.0	2.3	2.6	3.0	3.4	3.7	4.2	4.6	5.1	5.6	6.0	6.5
2000	300	4840	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7	0.8	0.9	1.0	1.1	1.2	1.3
	500	8750	0.5	0.5	0.6	0.7	0.7	0.8	0.9	1.1	1.2	1.3	1.5	1.7	1.9	2.0	2.2	2.4
	750	13900	0.7	0.8	0.9	1.0	1.1	1.2	1.4	1.6	1.8	2.0	2.2	2.5	2.8	3.0	3.2	3.5
	1000	19300	1.0	1.2	1.3	1.5	1.6	1.8	2.0	2.3	2.6	2.9	3.2	3.7	4.1	4.5	4.8	5.2
2500	300	4840	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7	0.8	0.9	1.0	1.0
	500	8750	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.9	1.0	1.1	1.2	1.3	1.5	1.6	1.7	1.9
	750	13900	0.6	0.7	0.8	0.9	0.9	1.1	1.2	1.4	1.5	1.7	1.9	2.1	2.4	2.6	2.8	3.0
	1000	19300	0.8	1.0	1.1	1.2	1.3	1.5	1.7	1.9	2.1	2.4	2.7	3.0	3.3	3.6	3.9	4.2

Tabulation of Computed Values of Illumination.

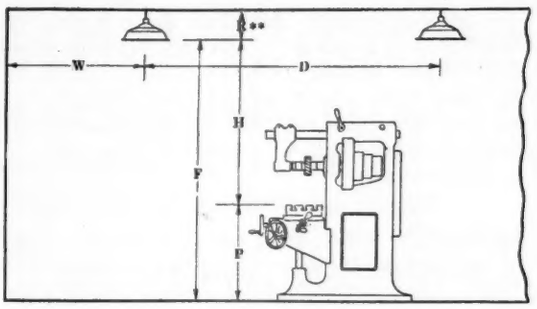


Diagram Showing Use of Direct Lighting Units.

Reference to the floor plan of the room shows that a 10-ft. spacing each way (outside units 5 ft. from walls) would make a symmetrical layout in the 20 ft. by 30 ft. bays and this spacing is therefore adopted. Outlet locations for the entire space are marked on the plan as shown, and 72 are found to be required.

(4) *Lamp Size.*—

(*A*) Area in sq. ft. per outlet

$$= \frac{\text{Total floor area in sq. ft.}}{\text{Number of outlets in room}}$$

$$= \frac{7200}{72} = 100$$

(*B*) Lamp lumens required per sq. ft.

$$= \frac{\text{Foot-candles} \times \text{depreciation factor}}{\text{Coefficient of utilization}}$$

$$= \frac{8 \times 1.30}{.57} = 18.2$$

With the area per outlet of 100 sq. ft., the desired illumination of 8 foot-candles, and the depreciation factor of 1.30, it remains to find coefficient of utilization.

From the room index table in a room 60 ft. by 120 ft. where the mounting height of direct lighting units above plane of work is 7 ft. the room index is 5.0 or in the same room where the mounting height is 8 ft. the room index is 4.0. Either value might be used for the room index with equal accuracy as to the result, but 4.0 is more conservative.

Referring to the table, "Coefficients of Utilization," for the RLM dome with bowl-enameled lamps in a location with a room index of 4.0, and where the ceiling and walls are fairly dark, the coefficient of utilization is found to be 0.57.

Combining (*A*) and (*B*)

(*C*) Lamp lumens required per outlet = area in sq. ft. per outlet × lamp lumens required per sq. ft. = 100 × 18.2 = 1820.

From the table giving the lumen output of lamps, a 150-watt type C lamp giving 2040 lumens is found to most nearly meet the requirement. The actual service illumination using this lamp will, of course, be slightly greater than originally designed for, or

$$\frac{2040}{1820} \times 8 = 8.9 \text{ foot-candles.}$$

As an approximate check on the computation reference may be made to the table of computed values where with a coefficient of utilization of 0.55 (the table value nearest to 0.57) and an area per lamp of 100 sq. ft. the illumination, using 150-watt type C lamps, is found to be 8.6 foot-candles.

"APPLIED ILLUMINATION" DESCRIBED AND ILLUSTRATED.

Rigid Specifications Laid Down as Descriptive of Essential Features of Good Local-Lighting System.

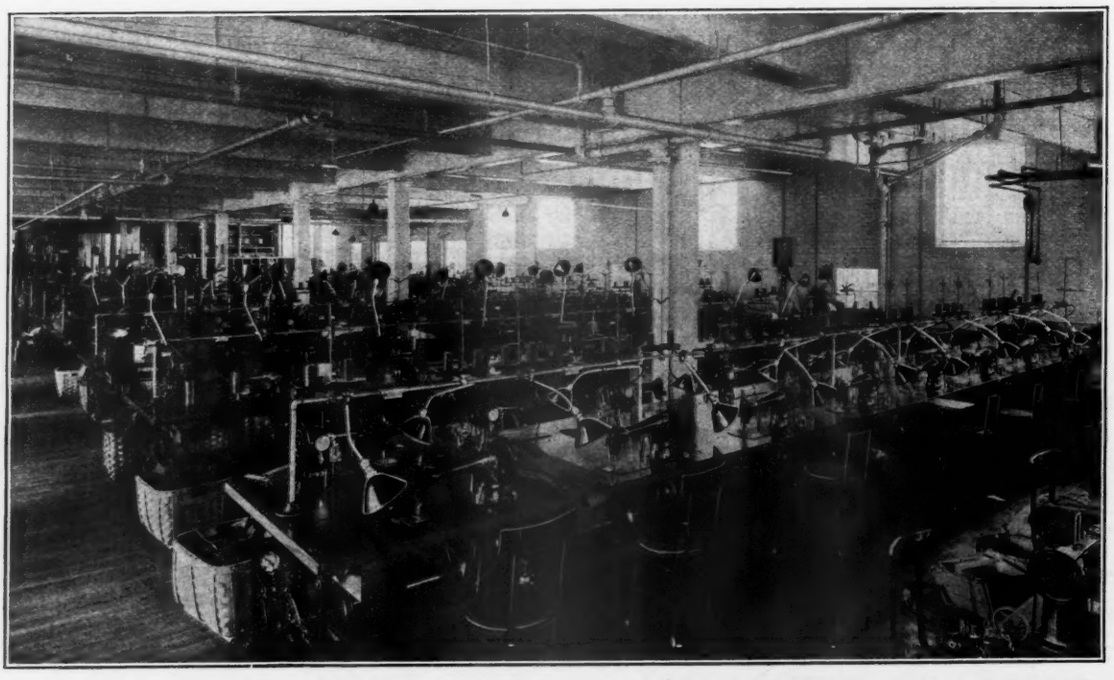
By O. C. WHITE.

The broad field of industrial lighting may be divided into two general classifications—"Applied Illumination" and "General Illumination." The term "Applied Illumination" is doubtless due to The O. C. White Co. of Worcester, Mass., who, as pioneers in this field, originated the expression over 25 years ago. Briefly, it means a flexible system for bringing artificial lighting directly to the work at hand, as compared with a fixed system to which the work must be accommodated. Both systems have their individual characteristics and respective uses. The system of "Applied Illumination" is indicated wherever there is to be a close application of individual effort; the system of "General Illumination" is adapted to the flood lighting of general or collective activities.

No practical system of general illumination has yet been devised which will eliminate all shadows and glare from the work of the individual; such results cannot reasonably be expected from such a system. Applied illumination, on the other hand, not only accomplishes these results, but secures the highest lighting effect on the work with a minimum expenditure of light. Applied illumination in its accomplishment necessarily requires some mechanical means for bringing the light to the work. To meet this requirement there have been developed the various types of adjustable lighting fixtures which are on the market today. Salient features which should be incorporated in successful adjustable electric fixtures are enumerated below:

(1) They should afford exact application of light to the desired working area. (2) They should eliminate all shadows and glare on the work. (3) They should have unrestricted adjustability within the entire working range. (4) They should have ample strength to hold the lamp securely in any desired position. (5) They should require no attention to joints or fastenings when adjusting the light. (6) They should be so designed that all joints and working parts may be instantly given any required tension to withstand working leverages. (7) They should permit the lamp to be immediately removed, entirely out of the way, when not required for use. (8) They should afford absolute protection to the wiring by thorough insulation at all abrasive points. (9) They should permit quick and easy wiring with approved flexible cord. (10) They should be built in sufficient variety of types, styles and sizes to fulfill, with highest efficiency, the many practical requirements of every class of technical or professional work of the individual.

"Out of the annual economic waste of $2,000,000,000 caused by accidents, it is estimated that 15% is due to defective illumination, or a total economic loss of $300,000,000 yearly to the country," declares R. E. Simpson, safety engineer of the Travelers Insurance Co. Mr. Simpson points out that by defective illumination he means the violation of the principles of good lighting. He says this is nowhere more evident than in the neglect of such details as the illumination of stairways, passageways and storage space, where as a result there are very many fatal falls. He adds that the total loss due to defective illumination exceeds the total annual cost of illumination.



Typical Installation of "Applied Illumination" in a Large Clothing Factory.

Developing Industrial Lighting

Part that Central Stations Must Play—Advice of Lamp and Reflector Manufacturers and Contractor-Dealers Mainly Sought—Facilities Available to Improve Conditions if Effort Is Made

The progress of illuminating engineering clearly indicates that new points of view must be taken by central station companies expecting to develop an expanding service in the rapidly growing field of industrial-plant lighting. One has only to compare the latest and best work with that which passed criticism two or three years ago in order to appreciate this. It would be difficult, in fact, to cite any branch of electrical development which offers larger opportunities for improvement than industrial-lighting practice, despite the fact that more attention has been given to illuminating problems than to any other issue, taking the life of the industry as a whole. The state of flux in which the industry now finds itself is in large part due to the progressive evolution of more efficient lamp filaments and to the manufacture of highly specialized and diversified types of reflectors, coupled with growing appreciation by industrial-plant owners of the practical possibilities of carefully planned installations, including those made for offices and drafting rooms as well as shops, good examples of which are illustrated herewith.

Problem for the Lighting Specialist.

The selection of lamps and reflectors for a given service is a distinct problem for the lighting specialist, and it must be so treated if the plant owner is to be given the best results. In too many past instances the aim appears to have been to sell the customer almost anything in the way of equipment to which he takes a fancy, without realizing that high-class industrial illumination cannot be marketed over the counter. The trouble has been that not enough pains have been taken to determine the best equipment in specific cases, and again, that inadequate means have been at hand to demonstrate to the customer the relative merits of different lighting schemes. It almost goes without saying that the plant owner is the final judge of what shall be installed on his premises, but even so, more care should be taken to give him a practical demonstration of what can be expected from the equipment recommended to him. In other words, there is room for more empirical work in selling light. The day is coming when important and costly installations of electric lighting equipment will be made according to the recommendations of men having more than a superficial knowledge of plant architecture, interior finishing and arrangements, as well as physiological and psychological conditions relating to illumination, and not hurriedly rushed into service without any genuinely scientific study of the case in hand. The customer takes all improvements as a matter of course. His temperature never rises a fraction of a degree over the announcement of a notable gain in lighting, but far-sighted illuminating engineers and lamp, reflector and fixture manufacturers are beginning to realize that cost of installation and operation is bound in time to become a subordinate issue to the plant owner capable of appreciating what really first-class service will do for him.

Opportunity for Great Increase in Industrial Lighting Business.

In a report made to the National Electric Light Association by its division on industrial lighting the essential facts concerning the present situation from the central-station standpoint were brought out, as follows:

Experience during the past few years has clearly established the fact that daylight standards of artificial lighting are attainable at relatively low cost; that through the installation of such facilities the product of the country's manufacturing establishments may be very materially augmented without an increase in the number of workmen or in plant equipment. So deficient, however, are the present lighting facilities in general that the central-station load for this service may easily be quadrupled within a few years.

Drafting Room Illuminated to 17-Foot-Candles With Ivanhoe Keldon Units.

Where the higher intensities of illumination are installed, the systems are operated during such a large number of working hours that the load-factor is vastly improved over that commonly obtaining in this class of business.

Information as to requirements of industrial lighting and how to meet them has been well organized. Equipments with which the desired results may be secured have been standardized and made readily available. A popular type of instrument, the foot-candle meter, is now available and is being widely distributed; it makes lighting a quantitative art as readily measurable as temperature, tire pressure, etc.

While the central station is the factor of the electrical industry constantly in contact with the customer, and while it has most at stake in this matter, it has often failed to put itself in the position of being able to advise its customers intelli-

Views in Plant of Everwear Hosiery Co., Showing Use of 22-In. Maxolite Diffusers.

gently. Thus, lighting practices have been adopted which are harmful to the best interests of both the consumer and the central station—practices which have automatically limited the amount of light which the customer could use advantageously.

Skill and Training Required to Attain Maximum Results.

To develop the possibilities for energy sales in this field men of ability, thoroughly informed on the subject of illumination, and capable of commanding respect as experts, are needed to conduct the sales effort.

The status of the central-station industry in this field is indicated by the results of a comprehensive survey covering several hundred plants throughout the industrial section of the country, as reported in the Jan. 24, 1920, issue of Electrical Review. It was found that but 9.2% of these plants seek advice from the central station regarding the lighting of their plants, while 52% of them would consult the electrical distributor or manufacturer. The central stations have developed the industrial-power load to its present large proportions through representatives who have commanded the standing of experts and leaders in power applications. They should similarly be organized to lead in the "better factory lighting" movement and to secure the cooperation of all of the electrical interests of a city, to the end that in every case the consumer may be properly advised and secure an installation which will give the greatest satisfaction. But this position cannot be established or maintained without capable men trained for this service. In the larger cities these representatives may be experts who devote their entire attention to the industrial lighting field, and in the smaller cities men trained and active in all illumination fields.

If the central stations meet this opportunity for service to industry, by the most conservative estimate, literally tens of millions of dollars may be added to their revenue, with a return of hundreds of millions of dollars to the owners of industrial plants and their employes. It means not only the saving of life, limb, and health generally, but also the further development of the country's productive efficiency.

NEW RATES AT HOLLIS, OKLA.

The Corporation Commission of Oklahoma has granted an increase in rates to the Hollis (Okla.) Light & Ice Co. The old rates were $0.16 per kw-hr. for current from 1 to 25 kw-hrs., and slightly lower charges for larger consumers. The new rate granted by the Commission is $0.18 per kw-hr. for the first 25 kw-hrs. used per month, graded downward in price according to the quantity of electricity used.

Figures show that the average person now uses more than 12 times the amount of electricity that he used 18 years ago. An army of 1,400,000 men and women are owners now of stocks and bonds of the electric companies, and more than $300,000,000 of public funds in the hands of insurance companies and $1,700,000,000 in bank funds is invested in public utility securities.

INDUSTRIES WANT CONTINUATION SCHOOLS TO REMAIN.

Improvements Desired in New York to Make Schools Conform to Needs of Pupils and Their Employment.

"Unless New York takes immediate steps to improve instead of to abolish the continuation school system authorized in 1919 by the Lockwood Law it will find itself far behind the other 18 states which have arranged their educational programs to give the younger members of the working class an opportunity to continue their studies by part-time application," is the comment of A. E. Kidd, chairman of the committee of coordinating unemployment activities in New York City, an organization which includes representatives of most of the big industries in the metropolitan district. He states also that "the Fearon Bill which is now before the legislature, and which advocates the abolition of the 'poor boy' schools, would mean a big step backwards in the educational progress of the state."

Mr. Kidd, who is also assistant personnel manager of the Western Electric Co., and who takes an important part in the management of the apprenticeship courses conducted by that concern, maintains that the five continuation schools which have been in existence since last September have done a great work in aiding employed boys and girls to finish their educations.

The only fault, as the committee sees it, is that the compulsory continuation methods now in vogue have not reached the stage where they fully aid the pupils to advance in their chosen fields. There is still a tendency in the school circles to force upon the students subjects in which they have no interest. In some cases it was a dislike for the very same subjects that influenced the youngsters to quit their attendance at the ordinary elementary or high schools. Mr. Kidd believes that youngsters with firmly fixed ambitions to follow some certain trade or profession will be given more consideration in the continuation schools in the future if the committee accomplishes its purpose.

Under the present law governing continuation schools in New York all the younger workers between 14 and 18 years old, who entered business before completing a high-school course, must devote a few hours daily in certain specified continuation schools. No adequate provision is made to give them courses that will help them in their chosen fields of commercial activity. Efforts are being made to readjust the continuation schools to meet the changes in economic conditions. It is proposed by the committee to devote more attention to vocational guidance and the laying out of special lines of study to aid the younger element in the branches of business they are seeking to follow. Distasteful subjects will be dropped in favor of those more intimately interesting to the individuals in the classes. It is realized that there must always be a younger element in business. To give these youngsters opportunity to gain the same basic education as graduates of high schools is the chief reason for the suggested reform, and the "never had a chance" excuse will be badly shattered under the new plans.

Highway Lighting Improves Night Traffic Conditions

High Efficiency Obtained by New Type of Equipment Undergoing Practical Trial—Lamps of Moderate Size Utilized—Lighting of Country Roads Provides Pole Lines to Carry Service to Farms

By C. D. WAGONER

With an astounding percentage of automobile accidents at night credited to headlight glare—something the many types of reflectors and lenses does not entirely eliminate—a new plan for making the country highways as safe as the well-lighted city streets will be welcome news to the thousands who use the highways. This new plan for banishing the glaring headlight does not call for any change in the automobile or its headlight. There are now hundreds of different kinds of lights and reflectors advertised as a cure for this evil which is annually costing so many lives, but still the accidents occur with the same excuse—blinded by the other fellow's headlight.

Some Advantages of Highway Lighting

Prevent accidents by showing up dangerous curves, by reducing headlight glare and by illuminating signs, sides of roads and other obstacles.

Add to comfort of night driving by relieving eye strain, by assisting in making repairs and by discouraging hold-ups.

Increase night traffic and thereby relieve day congestion.

Decrease running time and increase road capacity.

Will help bring electricity to the farm by providing a pole line.

Will increase real estate values by tending to extend city along highways and by bringing electrical conveniences into the homes.

A simple economic way for illuminating the highways so that there will be no more need for the glaring lights on the country roads than on the city streets is the solution of the problem offered by the General Electric Co., which has just completed a new type incandescent-lamp reflector after months of study and experimenting by the company's corps of illuminating engineers. A test installation has been made at Swamscott, Mass., which has fulfilled the pledges and predictions of the designers—a well lighted highway without a great waste of illumination on the adjoining fields.

An incandescent lamp of 250 candle power is all that is needed in these reflectors, placed at a height of 30 ft. at distances from 400 to 600 ft. apart, to illuminate the roadway so well that there is no need for the glaring headlights.

Description of Reflector Equipment for Highway Illumination.

This new type of reflector, known as the "parabolic nest highway lighting unit," embodies an entirely new and distinct feature for collecting the light rays and casting them only where needed. Engineers have spent years studying schemes to prevent the illumination of fields adjoining roadways and yet have a light that would properly illuminate the road and do so without glare. A nest of reflectors, or a series of three, one within the other, is the outstanding feature of the new unit. There are similar openings on either end, and by this means the greater part of the light that would be lost under ordinary conditions by reflecting upward and out to the adjoining fields is collected and cast in either direction upon the road surface. The rays that would escape if only the one reflector was used are picked up by the inner reflectors and directed toward the roadway at an angle of 10 deg. below the horizontal, giving the same effect as an overhead reflector 15 ft. in diameter. The white reflecting surfaces of the unit reduces the glare

Diagram Showing Direction of Light Rays From Highway Unit.

Night View of Paradise Road, Showing Effects Produced by Highway Units.

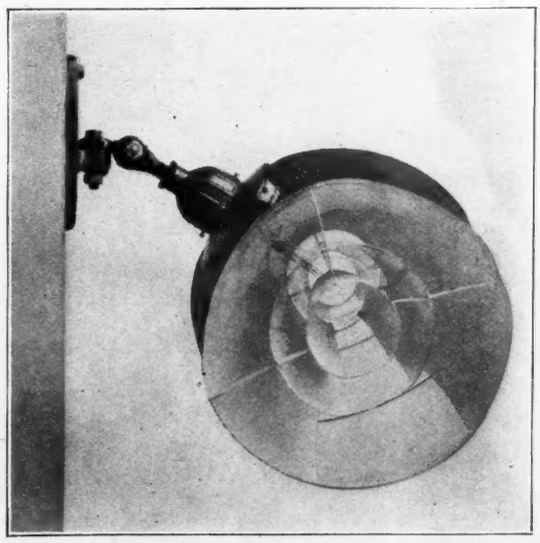
from the incandescent lamp without the aid of diffusing globes. The fixture also affords a much better protection to the globe than is offered by the type of reflector now found on some highways on the outskirts of cities.

The bracket holding the reflectors is adjustable in both vertical and horizontal directions so that the fixture can be mounted on poles close to the edge of the highway or on others which may be back many feet, and can also be turned so as to illuminate curves and hillsides. In other words, the opening in the lower part of the reflector can be kept practically parallel and in line with the road surface under any conditions.

Analysis of Accidents Attributed to Lack of Road Light.

A survey was recently made in the city of Cleveland of the 3540 traffic accidents that occurred during one year. This was done to show as far as possible how many of the 1059 accidents which occurred after dark would have been avoided if daylight or its equivalent had been available. It showed that 292 accidents, 14 of which were classed as fatal, were directly attributed to lack of light. This conclusion was reached by comparing the number of accidents during the hours of the night which are light in the summer and dark in the winter. The conditions in Cleveland are considered typical of those in other large cities, all tending to show the need for better illumination of the country highways.

Now that a lighting unit has been developed which appears to have solved the problem so far as illumination is concerned there remains but one outstanding obstacle to make the highways safe at night, and that is a plan for apportioning the expense of the improvement. Farmers who own land adjoining the roads claim their benefit will be but small as compared to what autoists from all parts of the state and country will receive.



Parabolic Nest Highway Lighting Unit, Showing Lamp and Supports.

They feel the installing should be done the same as roads are improved, since this is an improvement to traffic just as essential as a smooth road surface. It is a job for the adjoining cities or the state highway departments, they feel.

Day View of Paradise Road, Showing Method of Mounting Equipment.

Several communities have already become interested and plan installations of the new lights for short distances, and it is believed that when the decided advantages of better light for country roads are actually seen a step in soliciting the help of the states will be taken, perhaps being fostered by automobile clubs and organizations whose members would derive the greatest benefit.

MAINTENANCE AS A BIG FACTOR IN INDUSTRIAL LIGHTING.

Good Lamps and Good Reflectors Will Fail to Give Satisfactory Illumination If Not Properly Maintained After Installation.

By O. J. Thompson.

Successful industrial illumination depends upon the installation of the proper type of equipment and upon the maintenance and care given this equipment by the user. The failure of any of these factors prevents the successful functioning of the others. In the development of lamps, reflectors and socket devices it can be said that the makers of such equipment have spared and are sparing no effort to make lighting applicable and efficient for the needs of industry at large. But no matter how well equipment is designed and made, or how well it is installed to serve the purpose of the user, it cannot be designed, made or installed to maintain itself.

Unless users of industrial lighting equipment recognize the functions that devolve upon them they will be disappointed with the results obtained. It follows, then, that those who supply equipment and make installations owe it to the users and to the electric lighting industry to put emphasis on the necessity of properly maintaining equipment to secure maximum results.

As maintenance depends solely on the human factor, and nothing else, it would seem appropriate to study that human factor with the view of determining just what can be done to procure from it the desired results. Everyone is familiar with the natural human tendency to neglect or avoid work that is attended with difficulty or danger. In the present-day system of installing high lamps there are two ways in which they can be properly maintained. One is by climbing ladders and, in some instances, climbing out on overhead beams to inspect and clean the lamp globes and

reflectors. The other is through a reversion to the method, though an improved one, used to clean the old-style arc lamps, that of having the lamps suspended on a disconnecting hanger so the lamp, globe and reflector can be lowered to the floor level and there cleaned without resorting to the awkward, difficult and often dangerous method of climbing to them by means of a ladder.

Devices have been perfected that allow the lamp to be lowered to the floor without long loops of wire coming down with it. The lamp drops away from the socket connection in the wall, ceiling or roof beam, as the case may be, leaving the wiring undisturbed, and when the lamp has been cleaned it is pulled back up to the socket, goes automatically back into the circuit and locks there.

Many large industrial plants after adopting this method find that not only is there an increase in the efficiency of the lights, but that the cost of installation of the hanger is more than made up in the saving in cost of keeping lamps, globes and reflectors clean.

ILLUMINATION IN A MODERN STEAM LAUNDRY PLANT.

Special Problem Presented by Presence of Steam and Other Vapors Resulting From Processes Carried On.

By H. Logan,

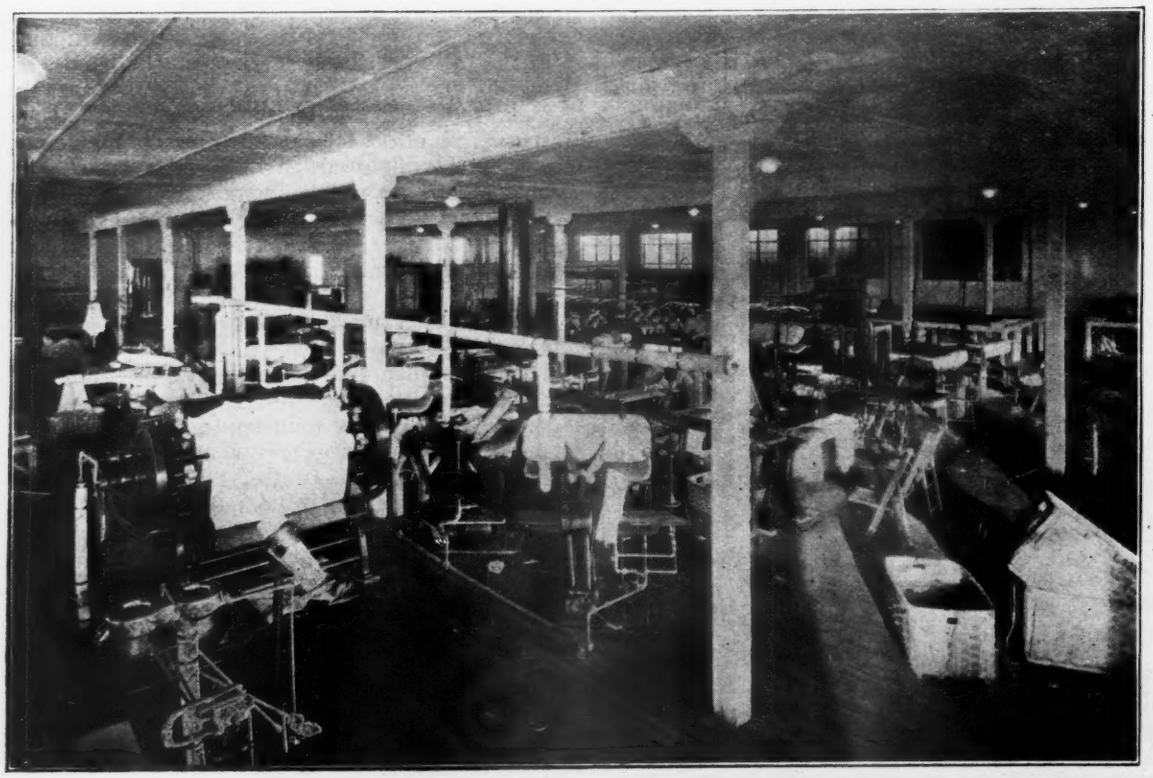
Electrical Engineer, Holophane Glass Co., New York City.

The business of cleaning clothes is most ancient. Even the business of cleaning clothes with mechanical equipment is hoary with the weight of accumulated years, but the business of steam laundering carried on by, comparatively speaking, big companies with all sorts of mechanical washers, wringers, ironers and pressers is of modern development.

Some—the most recent of these companies—are housed in modern buildings constructed and equipped according to the most approved plans, while the others are getting out of their old dingy quarters into structures more nearly in accord with the progressive ideas of the age as quickly as opportunity offers. It is inevitable that with the growth and expansion of this most modern yet oldest of businesses the necessity for good lighting should be more keenly felt. Moreover, with the gradual improvement in lighting equipment and practice has come, particularly in the more recent establishments, higher ceilings, light-colored surroundings, the elimination of overhead shafting and attachments and similar changes that, while not in the relation of cause to effect, tend towards the betterment of lighting and facilitate the use of modern illuminating equipment.

Certain Locations Difficult to Illuminate in Laundry.

In an up-to-date laundry there are only two departments where difficulty will be found in obtaining satisfactory illumination. Due to the constant presence of steam vapors carrying dirt and bleaching chemicals in suspension arising from the machines in the washing department, and from the clothes in the drying department, lighting equipment quickly receives a brownish coating that destroys its efficiency. Maintenance is usually difficult and seldom resorted to, although that is the obvious solution. Therefore for these departments equipment that will not deteriorate in the presence of acid and steam vapors and that will suffer the least loss of useful light from the effects of the coating must be chosen. Attention should also be paid to the other qualities of good lighting



Good Example of Modern Illumination in Up-to-Date Steam Laundry.

equipment, such as high initial efficiency and ease of access to the lamp.

In these departments an intensity of 2 foot-candles represents the minimum permissible illumination with 4 foot-candles considered as fair and 6 to 8 foot-candles as desirable practice. Direct light with a slight diffuse tendency and the extensive type of distribution is best, delivered by an "overhead" system.

Special Features Applying to Ironing and Pressing Departments.

In the ironing and pressing departments maintenance is less of a problem, these rooms being free from anything except a slight clean steam vapor. But a peculiarity in the directional character of the light required determines the equipment that will be suitable. Due to the manner in which the pressing machines operate, i. e., the opening and closing of horizontal jaws, the horizontal rolling action of the ironing machines, and also the positions of machine controls and adjustable parts, the light must be delivered more nearly horizontally than vertically.

In the usual double-roller mangle the rollers should be lighted all the way in to their point of contact, as smooth placement of the articles to be ironed is facilitated, supervision of the operation made easier and the operator's safety enhanced by such illumination. The type of distribution required lies therefore between the "extensive" and so-called "street-lighting" types,* the units being employed in an "overhead" system.

An intensity of three foot-candles is the minimum advisable for these departments, six is good practice while ten is desirable.

Proper Illumination for Sorting, Marking and Wrapping Departments.

The sorting, marking and wrapping departments offer no special characteristics. Uniform illumination, an intensity of from 3 to 8 foot-candles, with an extensive distribution are the requirements. In a modern laundry at Columbus, O., recently equipped with a satisfactory system, shown in the accompanying illustration, a prismatic unit of the "reflector-refractor" type, mounted 10 ft. from the floor on 19-ft. centers and supplied with 200-watt type C lamps, was employed in the washing, drying, ironing and pressing rooms.

The light intensity after the laundry had been in operation two months, the units not having been cleaned since installation, was found to be 3 foot-candles in the washing and drying rooms on the first floor, and 5 foot-candles in the pressing, ironing, sorting, marking and packing departments. The sorting and marking departments are on the first floor, the others being on the second floor.

In the sorting, marking and packing departments the same type unit is used, but of a smaller size, at lower mounting heights and closer spacing distances to give the same wattage per square foot and to obtain more uniform distribution. Similar larger units were placed in the offices so as to give an intensity of 8 foot-candles, and provide satisfactory illumination for this department.

*The maximum candle-power should lie between 40 and 80 deg. (preferably 55 deg.).

EDUCATIONAL FILMS DISTRIBUTED THROUGHOUT WORLD.

Wide Distribution of Industrial Pictures Taken Advantage of by Schools and to Influence Trade Relations.

The important role which moving pictures of industrial subjects are playing in the continuation schools of the country is fittingly demonstrated by the study just completed by Charles W. Barrell, director of the motion picture bureau of the Western Electric Co. During 1920 over 2,000,000 people throughout the country attended special performances at which the educational pictures produced by the Western Electric Co. were featured.

One of the most active advocates of the industrial "movie" idea is the educational department of the Y. M. C. A. The great welfare organization reports that it exhibited 1008 Western Electric industrial films to the personnel of its evening schools last year, and that 302,679 students of the Y. M. C. A. classes attended the exhibitions. The board of education of New York City has also made frequent use of the industrial reels. Miss Rita Hochheimer, of the visual instruction bureau of the board, states that the films have proved valuable aids in acquainting the young workers in the industries (who spend a few hours each week in school) with the opportunities in their various trades.

Several of the universities which have special departments of industrial research have been making a study of the value of the films put out by the manufacturing companies to aid the progress of the younger factory operatives. The educators lay particular emphasis upon the broader vision gained by the worker who is thus enabled to see clearly his real relations with his fellows of kindred trades. Most of the state universities are also using the cinema in their extension course to teach modern methods of farming and housekeeping to the citizens of the rural districts.

The Western Electric Co. is about to release seven new one-reel films. Six of them are devoted to the lumber industry and its relations to the telephone and telegraph systems of the world. The seventh, "A Concrete Example," refers to the importance concrete construction is playing in building operations in New York City. It features the building of the largest concrete structure on Manhattan Island—a warehouse and office building occupied jointly by the New York Telephone Co. and the Western Electric Co.

Arrangements have just been completed for a release of several industrial films in South America. They will include subjects of particular interest to the natives of the southern continent, such as scientific farming, the development of lines of communication, and a study of modern electrical inventions.

The introduction of new American educational films into Brazil is looked upon as an extremely interesting experiment. It is said that, due to the exchange situation and the influence of European picture interests there, American film distributors some time ago gave up the field in despair. The release of the American industrial films in Brazil will have an influence on future industrial relations with that country.

EDITORIAL COMMENT

Primary Requisite in Industrial Lighting

A writer in the ELECTRICAL REVIEW, many years ago, brought out the fact, which cannot too often be repeated or emphasized, that the human eye, being accustomed to the natural light of day, which is a diffused light and in part reflected from surrounding objects, is especially adapted to that character of light. Any other illuminant varying from daylight in quality, direction of source or intensity must necessarily create an abnormal condition, in a sense, in its effect on the delicate retina. The eye is also so closely related to the physical and mental condition of man that abnormal conditions of light continued for any appreciable period must certainly tend to create other abnormalities either in mind or body.

The eye, however, is by nature the most perfect self-adjusting mechanism known, and adapts itself without volition even to great changes in quality and quantity of illumination, thus, to some extent offering a corrective to abnormal conditions that might otherwise become very pronounced. Much could be cited in relation to this subtle relation between the eye, as affected by variations in light, and the physical functioning of other organs. In fact, many volumes might be written dealing with ocular lesions brought about by the improper use of illuminants, and the subject becomes one of especial importance in dealing with its effect on the health and efficiency of labor in industrial plants.

Correct and adequate illumination creates a feeling of cheerfulness, activity and alertness, both mental and physical, illustrated by the fact that natural daylight when properly admitted and diffused is more conducive to the satisfactory performance of practically all shop, mill or factory work.

The eye being the gage by which the success or failure of a system must largely be determined, the first and probably the most important item to receive attention is naturally that of quantity or intensity of illumination; that is, any lighting system to be satisfactory must first of all supply sufficient illumination to each workman, and the intensity should preferably be adequate irrespective of his exact position on the floor. This presupposes that the illumination is furnished from lamps mounted overhead rather than from individual lamps close to each piece of work. In a great many cases this plan is entirely feasible; in others, the confining nature of the work, that is, its location at a fixed point of very small area, may make it impossible to provide fully adequate light from an overhead system, and here individual lamps may be essential.

Furthermore, in securing proper lighting certain conditions are discovered to be inherent to the building under consideration, such as the reflective coefficients of the ceiling, walls and equipment installed, as well as the height of the ceiling and location of windows. Of course, if the greatest lighting economy is to be secured, the designer of the system must have in mind a proper layout from the preliminary building plan to the ultimate completion of the plant, but if the building is already completed refinishing of the interior, relocation and improvement of lighting units and minor changes are sometimes all that the circumstances will permit. The interior finish or painting of a building has in itself, however, a direct bearing on the cost and effectiveness of lighting, and much more may be accomplished by properly designing and installing the fixtures, lamps, reflectors, etc.

Incorrect illumination, if the light is insufficient, creates a feeling of lassitude, slowness and gloom very strikingly shown by the effects of natural darkness falling upon those people removed from any considerable quantity of artificial light. On the other hand, an illumination productive of glare creates oversensitiveness, nervousness and mental strain; and badly directed light may be the cause of actual ocular lesions which lead to serious physical disorders. There are, indeed, so many diverse factors entering into the problem that each individual installation for industrial lighting should be made the subject of separate and distinct study, bearing always in mind the primary requirement that the system selected must be adapted to the eye itself, not the eye to the system.

A Vicious Ordinance—Its National Significance

The ELECTRICAL REVIEW has been supplied with a typewritten copy of an ordinance which has been prepared for introduction in the Common Council of the City of Chicago. The provisions of this ordinance speak for themselves. If passed, it would not only constitute a serious check on the electrical industry and open the way to unlimited graft; but it would establish a very dangerous precedent for similar action by state and municipal bodies throughout the country.

The ordinance follows:

AN ORDINANCE TO REGULATE THE SALE, INSTALLATION, AND USE OF ELECTRICAL DEVICES.

BE IT ORDAINED BY THE CITY COUNCIL, CITY OF CHICAGO:

Section 1.—License required to sell.—That no person, firm or corporation shall engage in the business of disposing of, selling or offering for sale any fixture, fitting, apparatus, appliance or device of any character whatever intended to be used within the City of Chicago for the generation, transmission or utilization of electrical current for light, heat or power purposes unless such person, firm or corporation shall have obtained a license so to do from the City of Chicago; provided, however, that electricians licensed under the ordinances of the City of Chicago for the installation of wires and apparatus for light, heat and power purposes and disposing of or selling only such fixtures, fittings, apparatus, appliances or devices as are installed by them under the authority of permits issued by the Commissioner of Gas and Electricity shall be exempt from the requirements of this section.

Section 2.—Approval of materials and devices.—No person, firm or corporation shall install, use, dispose of, sell or offer for sale any electrical fixture, fitting, apparatus, appliance or device of any character whatever intended to be used within the City of Chicago for the generation, transmission or utilization of electrical current for light, heat or power purposes unless the same shall have been first approved by the Commissioner of Gas and Electricity.

Section 3.—Licenses—Applications—Fees. Any person, firm or corporation desiring to engage in the business of disposing of, selling or offering for sale any electrical device of the type described in *Section 1* hereof, shall make application so to do to the Commissioner of Gas and Electricity on a form approved by him. Such application shall contain the business name and business address of such person, firm or corporation and such other information as the Commissioner of Gas and Electricity shall require, and shall also contain an agreement made by the applicant to dispose of, sell or offer for sale for use in the City of Chicago only such materials or devices described in *Section 1* hereof as have been approved by the Commissioner of Gas and Electricity. Upon filling such application in proper form and upon the deposit of the license fee of Fifty dollars ($50.00), the Commissioner of Gas and Electricity shall issue to the applicant a license permitting him to dispose of or sell such materials or devices for a period of one (1) year from the date of the issuance of said license. Said license may be renewed for an annual fee of Fifty dollars ($50.00) and shall not be transferable.

Section 4.—Licenses—Number required.—Where a person, firm or corporation shall engage in the business described in *Section 1* herein, at more than one location or place of business, a separate license shall be obtained for each such location or place of business.

Section 5.—Revocation of license.—The Mayor may revoke the license of any licensed electrical dealer for the violation of this or any ordinance of the City of Chicago relating to the disposal or sale of electrical materials or devices of the class mentioned in *Section 1* of this ordinance, or if in his discretion the holder of such license is incompetent or unfit.

Section 6.—Materials and devices—Applications—Fees—Examination approval.—Before any electrical fixture, fitting, apparatus, appliance or device of any character whatever to be used within the City of Chicago for the generation, transmission or utilization of electrical current for light, heat or power purposes, shall be installed, used, sold or offered for sale,, it must be approved by the Commissioner of Gas and Electricity. Application for approval must be made on a form approved by the Commissioner of Gas and Electricity. Such application shall contain a complete description of the device submitted, also an agreement to manufacture or construct the device described in strict accordance with such description and the sample submitted, and a further agreement that should any change be made by the applicant in the material or device to resubmit the same for examination and test before introducing same for sale or use. A preliminary examination fee of Five dollars ($5.00) shall accompany the application. The Commissioner of Gas and Electricity shall subject the material or device to such examination and test as will in his judgment determine its ability to safely and properly fulfill the purpose for which it is intended; provided, that the said Commissioner of Gas and Electricity may, at his option, accept reports of examinations and tests made by recognized testing laboratories. Upon successfully meeting the examination and test requirements herein provided, the Commissioner of Gas and Electricity shall issue a certificate of approval which shall permit the sale and use, in accordance with the laws and ordinances, of the material or devices within the City of Chicago. Previous to the issuance of such certificate of approval, an additional fee shall be paid to the Commissioner of Gas and Electricity and such fee shall be based upon the amount of time and expense involved in such examination and approval. In case the device or material submitted fails to meet the approval of the Commissioner of Gas and Electricity the preliminary fee shall be retained by him and an additional charge shall be made based upon the time and expense involved in such examination and test. Separate applications must be made and approvals obtained for each device submitted.

Section 7.—Re-examination of materials and devices.—Following the original approval of a device or material, as described in the foregoing section, the Commissioner of Gas and Electricity shall make, at least once in each subsequent year, a re-examination of such device or material for the purpose of ascertaining if the same complies with the device or material originally submitted and approved, and a charge of Five dollars ($5.00) shall be made for such yearly re-examination.

Section 8.—Marking for materials and devices.—The maker's name, trade mark or other identification symbol must be placed on all fittings and materials approved by the Commissioner of Gas and Electricity, and all such fittings and materials must, when required by the Commissioner of Gas and Electricity, be provided with the voltage, current, wattage or other appropriate marking. No material or device shall be disposed of, sold or offered for sale when the same is accompanied by instructions, suggestions or recommendations to over-fuse any circuit, to attach or connect the device to any socket or receptacle of insufficient capacity or to instruct, suggest or recommend any other act therewith

a compliance with which would result in a violation of any ordinance of the City of Chicago; and the disposition, sale, offering for sale or advertising of any such material or device shall be considered a violation of this ordinance and subject to the penalty provided in *Section 11* herein. The Commissioner of Gas and Electricity is hereby empowered to refuse approval or to withdraw approval of any such device or material.

Section 9.—Temporary permits.—The Commissioner of Gas and Electricity may issue temporary permits allowing the use of devices or materials pending their final examination and approval, but such temporary permits shall become void upon the final approval or disapproval of the device submitted. The preliminary examination fee shall be paid before such temporary permit is issued, and this fee shall be credited to the final examination fee as provided in *Section 6* herein.

Section 10.—Transfer of fees to city collector.—Upon the issuance of an original license, or the renewal of a license, or upon the final approval or disapproval or re-examination of a device, the Commissioner of Gas and Electricity shall transfer the fees so received to the City Collector.

Section 11.—Penalty.—Any person, firm or corporation who shall violate any of the provisions of this ordinance or who shall install, use, dispose of, sell or offer for sale any electrical fixture, fitting, apparatus, appliance or device of any character whatever intended to be used within the City of Chicago for the generation, transmission or utilization of electrical current for light, heat or power purposes which is not approved by the Commissioner of Gas and Electricity, or who shall engage in the business of disposing of, selling or offering for sale any such materials or devices without having obtained a license so to do, shall be fined not less than Fifty dollars ($50.00) nor more than One Hundred dollars ($100.00) for each offense, and each day's violation hereof shall constitute a separate offense.

Section 12.—Ordinance effective.—This ordinance shall be in effect from and after its passage and due publication.

That organized opposition will be offered to such a vicious measure goes without saying, and the ELECTRICAL REVIEW is already doing its part. Pending further comment and action, however, this journal will be glad to have the ideas and suggestions of its readers.

In the Electrical Industry Progress Is the Watchword

A remarkable work for the electrical industry has been accomplished by the Society for Electrical Development during the last 7 years. It has been along broad lines, embracing primarily the education of the public to an appreciation of electric service. This general subject has been subdivided into many phases, including electrical devices and appliances, principally in the home in ordinary every-day work; electric motors, in all the several phases of their use in factory, industry and home, and proper lighting, a field of research and development which took the incandescent lamp dangling from a wire and converted it into modern illumination.

Service within the industry has helped the retailer to solve some of the many problems which have arisen during the last 7 years, and to build up his business on a better foundation, a real foundation of merchandising, which notably is lacking in so many branches of retail selling. The outcome of this work has resulted in a spirit of co-operation in the industry, which has brought together the companies who have been contributing to the Society's support, and which has resulted in what might be called the spontaneous carrying on of this important spirit and the work that that conception of the industry has engendered.

Another influence has been at work fostering the same spirit of co-operation during the last 3 years. It has been drilled into jobbers, contractors and dealers throughout the length and breadth of the land by the addresses of William L. Goodwin, and as a result of this work many dealers and contractors have been imbued with the idea that electrical appliances are a household and industrial necessity, not merely conceding that point, but holding to it and preaching and practicing it both in season and out of season.

It was therefore more than satisfactory to have these influences brought together and working together, as they will be, by the appointment of Mr. Goodwin to the position of assistant to the president of the Society of Electrical Development. Mr. Goodwin brings to the Society a vast fund of information regarding conditions in the electrical industry which he has naturally acquired during the years of his experience, and the Society will now find the vehicle necessary to put into practical effect the many suggestions so frequently made at various trade meetings.

The world progresses. It was inevitable that some organization would be needed to make Mr. Goodwin's work of lasting benefit, and the industry is fortunate in that a way was found, without forming a new organization, for that particular purpose. The Society for Electrical Development is equipped with a competent staff. and has the support of all branches of the industry. Mr. Goodwin's aid in making the work more direct and potent will be everywhere felt.

The support of the industry at large is solicited by the Society, and upon that support is contingent, in a measure, the progress that can be made by Mr. Goodwin and the staff of the Society. It depends very largely upon the character of the support secured whether the Society makes quick progress or slow, but judging the future by the past, the Society has a large measure of progress in store for the industry.

THE WEEK'S NEWS

Reports of Important Meetings, Developments and Other Happenings of the Electrical Industry and Its Allied Interests

ELECTRICAL HOME ATTRACTS MUCH PUBLIC INTEREST.

Home Owners and Flat Dwellers Show Enthusiasm for Things That Can Be Secured by Means of Electric Service.

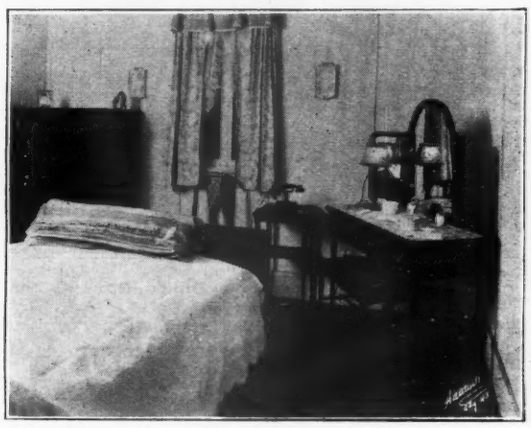
Without a doubt, the "Home Electrical" was the feature of the "Own Your Home" exposition held in Chicago during the week of March 28 to April 2. The house in which the display was made was too small to accommodate the great crowds of people who appeared to be anxious to find out what electricity could do for their own home, or for the home which they expected to build. A 4-room house with a hall and completely appointed bath room was erected especially and furnished and equipped for this demonstration. Carpets, furnishings, furniture and draperies all received due consideration, but the items that held the attention of the crowds were the "things electrical." It seems hardly possible that there could be so many people still seeking information as to how a vacuum cleaner, washing machine, ironing machine or dish washer operates. And still there were many to enquire about irons, electric heaters and ranges with still others wondering at and admiring the grace and effectiveness of floor and table lights.

Equipment in the bed rooms included regular suspended ceiling lighting fixtures, small shaded lamps on the dressers and on the stand at the bed, lamps mounted on the beds themselves, selective telephone equipment for answering the door phones or calls from the central office. In addition to these features there were outlets for convenience devices such as curling irons, vibrators, fans, heaters, electric pads, etc., so often found useful in the sleeping quarters. The bath-room equipment was quite unassuming, consisting of mirror lights with suitable switching and convenience outlets.

Many People Interested in Ornamental and Useful Devices.

Floor lamps, reading lamps, table lamps and parchment-shielded bracket lamps provided the illumination and ornamental features of the combination living and dining room. A fireplace at one end of this room was provided with an illuminated heater. The "Home Electrical" is always provided with the things that make for comfort and cheer. Better digestion and better health are encouraged by the cheerful, excellently appointed dining room. Soft decorative lighting adds greatly to the inviting qualities of the room. The electric buzzer provides communication with the kitchen. Upon the sideboard an electric disc stove and heating pads solve the problem of keeping food palatably hot. Here, too, are the percolator for coffee and the samovar for tea. At breakfast time—and perhaps at luncheon—the electric grill and the toaster will be brought in for piping hot dishes prepared at table. And at supper the electric chafing dish serves for savory culinary production.

There will need to be fans—they are effective for ventilation as well as cooling. The vacuum



View in Bed Room of the "Home Electrical."

cleaner will be often used to keep the room spotless. And on the nippy mornings of Spring, Fall and Winter the glow heater placed close to the table will make the meal cosier.

Living Room May Be Provided With Variety of Comforts.

So many of the most pleasant family hours are spent after sunset in the living room that the most careful attention should be given its lighting scheme. There should be numerous wall lights and convenient base-board sockets for the attachment of table and floor lamps and portable reading lights. The decorative effect of the lighting arrangement is a vital factor in the cheerfulness, comfort and livability of the room.

The phonograph and the player-piano should be electrically motored. The electric tea wagon will be used here, and occasionally the chafing dish for a dainty supper tidbit. The vacuum cleaner and floor polisher will be needed to keep things spic and span. The cigar lighter on the table should be electric, and the clock should be supplied with power from the same source.

Labor and time saving devices were much in evidence in the kitchen and pantry. The electrification of the kitchen begins with soft clear illumination, emphasizing spotless cleanliness. For the actual cookery there is the electric range and electric fireless cooker, with a clock control, if you please, which endows it with an almost human intelligence. A simple electric-motored device chops, slices, beats and mixes. Another grinds and polishes. And the electric dishwasher ends forever that disagreeable aftermath of greasy pots, pans and dishes. The electric re-

frigerator maintains a dry, unvarying cold, and dispenses with the iceman, while the electric water heater keeps up the supply of steaming hot water. Upon the smoothly finished floor and enameled shelves of the kitchen the vacuum cleaner is as efficient a cleaner as upon the rugs and draperies of other rooms. Electricity shoulders the labor of the kitchen and leaves just the pleasant tasks of judgment and skill. Be-

Combination Living Room and Dining Room in the Electrical Home.

cause of the lack of a basement under the display house the washing machinery and ironer were installed in the kitchen. Demonstrations of all these devices held the interested attention of visitors who asked endless chains of pointed questions regarding the devices to be seen and regarding many others which could not be shown on account of lack of space. The refrigerator in the plantry excited no end of comment, and the man in charge of this device was simply flooded with questions. Everyone seemed to want to know how they could preserve their perishable foods in an iceless icebox in their own home.

Real Service Features Still New to Great Numbers of People.

As has already been indicated, the space provided was entirely too small to accommodate the crowds. This fact should be considered by others contemplating the presentation of similar displays. An 8-room house, even, would have been too small to care for those interested in home equipment, and from the interest displayed it seems evident that other shows could be given with good results. When people flock into an exposition, paying a substantial admission fee, to see what is offered for sale, it seems evident that there is unlimited opportunity for business that is being neglected.

GREATER AUTHORITY FOR UTILITY COMMISSIONS.

Governor Sproul of Pennsylvania has signed a bill passed by the legislature giving the Public Service Commission authority over the joint rates of street-railway companies in the state covering the transportation of freight. The measure declares, expressly, that the power is not extended to cover the establishment of joint rates for passengers.

The New York Legislature has passed a bill giving greater authority to the Public Service Commission of the state, and it is believed that the measure will be approved by Governor Miller at an early date. In accordance with the new law, the commission will have the power to abrogate franchises and agreements between public-utility corporations and municipalities, and greater authority in other directions with respect to the relations between utility companies and municipalities. In accordance with the measure, the members of the commission will serve for a period of 15 years, and will be removable from office only by a two-thirds vote of the state legislature.

ELECTRIC SHOW WILL BE HELD IN KANSAS CITY.

Electrical Appliances and Apparatus to Be Featured in Missouri City During Week of April 18-23—List of Exhibitors.

A national exhibition by manufacturers of electrical appliances and apparatus is to be held April 18-23. This event, which will take place under the auspices of the Electrical Trades Exposition Co., of which Sam Furst, 802 Broadway, Kansas City, Mo., is manager, will be known as the Kansas City Electric Show and the exhibits are to be displayed in the Convention Hall, Kansas City, Mo., during that week. Two conventions will meet during the week of the Electric Show—the Kansas Public Service Association and the Missouri Association of Public Utilities.

A partial list of the exhibitors follows:

Ackerman-Johnson Co., Chicago.
Animated Advertising Co., Kansas City, Mo.
Apex Electric Distributing Co., Cleveland.
B-R Electric Co., Kansas City, Mo.
Bailey-Reynolds Co., Kansas City, Mo.
C. A. Buscher & Co., Kansas City, Mo.
Central States Electric Co., Kansas City, Mo.
Coyne Engineering & Trade School, Chicago.
Denton Engineering Co., Kansas City, Mo.
Edwards Light Co., Kansas City, Mo.
Edison Electric Appliance Co., Chicago.
Electric Contractors' Association, Kansas City, Mo.
Eureka Vacuum Cleaner Co., Detroit.
Evans Electric Co., Kansas City, Mo.
Faultless Washer Co., Kansas City, Mo.
Fortified Manufacturing Co., Kansas City, Mo.
French Battery & Carbon Co., Madison, Wis.
Funsten Electric Co., Kansas City, Mo.
General Electric Co., Schenectady, N. Y.
Hoover Suction Sweeper Co., North Canton, O.
Hubbard & Co., Pittsburgh.
Hurley Machine Co., Chicago.
Independent Electric Machinery Co., Kansas City, Mo.
International Brotherhood of Electric Wiremen, Kansas City, Mo.
J. W. Jenkins Music Co., Kansas City, Mo.
Joslyn Manufacturing & Supply Co., Chicago.
Kansas City Power & Light Co., Kansas City, Mo.
Kansas City Telephone Co., Kansas City, Mo.
Kansas City Light & Fixture Co., Kansas City, Mo.
King Manufacturing Co., St. Joseph, Mo.
Landers, Frary & Clark, New Britain, Conn.
Locke Insulator Co., Victor, N. Y.
Majestic Electric Development Co., San Francisco.
Modern Laundry Machine Co., Kansas City, Mo.
Missouri Valley Electric Co., Kansas City, Mo.
National Carbon Co., Cleveland.
Nagle Pole & Tie Co., Chicago.
1900 Washer Distributor Co., Kansas City, Mo.
Page & Hill Co., Minneapolis, Minn.
R. E. Parsons Electric Co., Kansas City, Mo
Rossner Light Fixture Co., Kansas City, Mo.
Satterlee Electric Co., Kansas City, Mo.
Standard Electric Stove Co., Kansas City, Mo.

Standard Underground Cable Co., Pittsburgh.
Stephens Chandelier Co., Kansas City, Mo.
C. A. Spaulding Electric Co., Kansas City, Mo.
Thordarson Electric Manufacturing Co., Chicago.
Vacuum Cleaner Sales Co., Kansas City, Mo.
Western Electric Co., New York City.
Westinghouse Companies, Pittsburgh.

NEW YORK ELECTRICAL SHOW WILL BE HELD THIS FALL.

It has been announced that the New York Electrical Exposition will be held at the 71st Regiment Armory, Park avenue and 34th street, New York City, during the 10 days beginning Sept. 28. With the Grand Central Palace no longer available for exposition purposes the show management was confronted with the problem of finding a place that combined suitable floor arrangements, facilities for handling the exhibits, and accommodations for spectators. The success of other shows that have been held in armories indicates that the requirements of the Electrical Show will be well met by the 71st Armory.

As in former years the 1921 show will feature electrical equipment for the home, motor-driven machinery for industrial purposes, electrically operated material-handling machinery, and electric vehicles.

PAGEANT OF PROGRESS EXPOSITION TO BE HELD IN CHICAGO.

Public Utilities to Occupy Exhibit Space—New Developments of Wireless Telephone Will Be Shown in Operation.

Many inventions which received their first practical tests in the great war, and which have never been demonstrated to the general public, will have their first public presentation in the exhibit of the public utilities, which will occupy a whole section of the Pageant of Progress Exposition to be held on Chicago's $5,000,000 Municipal Pier July 30-Aug. 14. George Foster, Commonwealth Edison Co., and William G. Keith, commissioner of gas and electricity of the City of Chicago, are co-operating in the arrangement of the utilities section and in gathering the new inventions for display.

New developments of the wireless telephone will be shown in operation. One of them is a device used with great success by the allies, after they had obtained possession of the German signal code, in deceiving the German aeroplanes and dirigible balloons out on raiding expeditions into remaining over allied territory until dawn, when they were surrounded by allied airmen and captured or shot down. The receiving apparatus of the device is enclosed in an iron pipe, and so arranged that it will receive messages only when the opening of the pipe is pointed straight at the sending station. By getting the location of one sending station when he picks up a message, and then turning slowly until he picks up another message, and getting the location of that station, the observer receiving the message is enabled to determine his exact position.

Another use of the same device is to enable ships to thread their way through dangerous channels in fog or darkness. When the pilot loses the message he knows he is headed toward danger. He swings his ship slowly until he again receives the waves, and "follows his nose" until he is past the danger.

Another development of the wireless telephone soon to be ready for practical use is a small receiving station which can be concealed beneath a coat lapel. Policemen equipped with this device could be notified from their stations, even though miles away, the instant a crime was reported. They could be told the direction taken by the criminals in the case of an attempted escape by automobile, and every policeman in the city could be on the alert for the fugitives 5 min. after the alarm had been given at a central station. Escape where a good description of the criminals had been obtained would be almost impossible.

WILL DISCUSS CENTRAL-STATION ELECTRIC SERVICE.

A symposium on central-station electric service will be held at the William Penn Hotel, Pittsburgh, Friday, April 15, by the Western Geographic Section of the Pennsylvania Electric Association.

In the morning, papers will be presented on "The Ideal Power Customer for the Central Station," by G. M. Gadsby, vice-president of the West Penn Power Co., and E. C. Stone, assistant to the general manager of the Duquesne Light Co., discussing this subject from the commercial and technical standpoints respectively. In the afternoon, "The Ideal Central Station Power Service" will be treated from the viewpoint of the steel plant by J. A. Coyle, general manager of the Universal Steel Co., and from the viewpoint of the coal mine by W. L. Affelder, assistant to the president of the Hillman Coal & Coke Co.

SALES OF GENERAL ELECTRIC CO. TOUCH HIGH POINT.

Orders Received in 1920 Aggregated More Than $300,000,000—Value of Sales Billed Last Year Made Record Figure of $275,758,487.

The report of the General Electrical Co. for 1920 shows that for the first time in its history the company last year received orders aggregating more than $300,000,000. At the same time the value of its sales billed touched a new high record figure of $275,758,487, an increase of $45,778,504 compared with that of the preceding year. Owing to heavy write-offs for inventories however, the net profits for the year were smaller than those of 1919. Net earnings after all charges, including taxes, amounted in 1920 to $22,132,288 or $15.92 a share earned on the $139,026,900 of the company's capital stock outstanding, which contrasts with $25,077,971, or $20.80 a share on its outstanding stock in 1919.

The company's balance sheet at the close of 1920 shows current assets of $226,953,860, against current liabilities of $81,753,245, leaving net working capital of $145,200,615. At the end of 1919 its working capital, as disclosed by its balance sheet, amounted to $117,851,096. Cash at the end of 1920 was $33,240,766, against $30,944,397 at the close of 1919, and receivables, $64,962,682, against $45,885,528. Fixed investments totalled $67,943,947 and investment securities

$63,766,644. Notes payable as of Dec. 31 were $45,979,357, but of that amount $41,992,000 was prepaid up to March 26 of this year.

"The unprecedented amount of orders," the report declares, "that were received by the company during the first 7 mo. of the year, plus the unfilled orders at the beginning of the year, resulted in most urgent efforts in a difficult situation to add to the manufacturing facilities. The expenditure for additional land, buildings, machinery and equipment during 1920 was $31,300,496, against which $15,577,360 has been written off plant account or added to general plant reserve, making the increase in the net book value of the plant and equipment $15,723,136."

The following table gives a comparison of the important items of the company's income accounts of 1920 and 1919.

	1920.	1919.
Orders received	$318,470,438	$237,623,932
Net sales billed	275,758,489	229,970,983
Cost of sales, including depreciation	231,494,444	196,855,680
Reduction of inventories to market	17,803,985	.....
Other income	8,960,558	5,230,921
Total income	35,420,015	38,355,221
Interest, etc.	4,288,327	2,277,250
Federal taxes	9,000,000	11,000,000
Net profit	22,132,288	25,077,971
Dividends	10,656,222	14,318,387
Surplus	11,476,065	10,759,584
Total surplus	70,048,610	64,010,245

E. M. C. APPOINTS TRANSPORTATION COMMITTEE.

The Electrical Manufacturers Council through its executive secretary, Frederic Nicholas, has announced the passing of resolutions of sympathy on the death on Feb. 18 of Edward B. Hatch, who had been a member since its organization on Feb. 7, 1916, and its treasurer from Nov. 7, 1919.

The Council has created a Transportation Committee composed of W. B. Everest, chairman; M. C. FitzGerald, A. T. Zwack and F. C. Bryan, to devote attention to matters of railroad freight classification.

Shiras Morris, president of the Hart & Hegeman Manufacturing Co., Hartford, Conn., has been elected treasurer of the Council for the unexpired term of the late Edward B. Hatch.

RATES FOR ELECTRICAL SERVICE IN OKLAHOMA.

The Corporation Commission of Oklahoma has made public figures showing that in ten of the principal cities of that state the average maximum rate for the first 500 kw.-hrs. of electric service in 1914 was $0.0846 per kw-hr. The average maximum rate for the same service in these same cities today is $0.0877 per kw-hr., according to the Commission, an advance of $0.0031 per kw-hr. in the rate. The ten cities included in this calculation are: Ardmore, Chickasha, Enid, El Reno, Guthrie, McAlester, Oklahoma City, Okmulgee, Shawnee and Tulsa.

WASHINGTON ENGINEERS IN JOINT MEETING AT SEATTLE.

Prof. E. O. Eastwood, secretary of the Washington Section of the American Society of Mechanical Engineers, which met jointly with the Seattle Chapter of the American Association of Engineers at Seattle, Wash., last month, spoke on the need for co-operation between the various branches of the engineering profession and expressed the wish that a live local organization similar to the Federated Engineering Societies could soon be formed. Ernest B. Hussey, representing the American Society of Civil Engineers of Washington, spoke on unity among engineers.

WISCONSIN DEALERS TO MEET.

The spring meeting of the Wisconsin State Association of Electrical Contractors and Dealers will be held at Appleton, Wis., Friday, April 22. This will be an executive committee meeting, together with the general business session.

STOKER ASSOCIATION TO DISCUSS COST ANALYSIS.

The Stoker Manufacturers Association will hold its annual meeting at the Red Lion Inn, Stockbridge, Mass., May 24-26. The Association plans to take up some very important matters at this meeting. For some time past, the Engineering Committee has been working on a universal coal analysis, and has also given considerable thought to the subject of a standard minimum setting height for each type of boiler. These matters, together with many others of considerable interest to the Association, will be brought up and discussed at the meeting. This annual meeting should be most interesting and the results of the work that the various committees have been doing for the past year will undoubtedly be of material benefit to the combustion field.

A NEW 40,000 HORSEPOWER UNIT FOR MINNEAPOLIS.

A new 30,000-kw. (40,000 hp.) steam-electric generating unit will be installed in the Riverside station of the Minneapolis General Electric Co. (Northern States Power Co.) by late summer or early fall, bringing the generating capacity of that station up to 127,200 hp. This improvement has been made necessary by the rapid growth of the company's business. Later a new 110,000-volt tie line between St. Paul and Minneapolis will be constructed to enable better distribution of power throughout the territory served by the company. In 1919 the capacity of the Riverside station was 36,000 hp., since which time it has been enlarged twice and the capacity increased three times, not including the present improvement nor the large water-power additions which have been made from time to time.

WESTERN ELECTRIC POST ELECTS NEW OFFICERS.

Western Electric Post, No. 497, of the American Legion, New York City, has elected the following officers to serve for the current year: Commander, J. C. Kennelty, 463 West street; first vice-commander, W. A. Ballinger, 463 West street; second vice-commander, G. I. Blanchard, 151 Fifth avenue; third vice-commander, E. P. Bancroft, 463 West street; adjutant, C. I. Fanning, 195 Broadway, and treasurer, H. J. Suika, 463 West street. The executive committee consists of G. C. Pratt, 195 Broadway; J. C. Cruger, 537 Greenwich street; D. D. Haggerty, 463 West street; J. P. White, 151 Fifth avenue, and S. G.

Zimmerman, 463 West street. The entertainment committee is lining up an interesting program. A smoker is scheduled at the Telephone Club for March 16. This meeting will be open to new and prospective members.

CONTROL OF POWER RIGHTS ABOVE NIAGARA FALLS.

Through an agreement with the Federal Power Commission, Washington, D. C., in conjunction with an agreement with companies applying for Niagara Falls power rights, the Niagara Falls (N. Y.) Power Co. will continue temporarily to have control over all water diverted from the Niagara river, above the falls, for power purposes. The commission has issued a notice to the effect that no applications for water rights will be considered which would depend upon the ratification of the pending treaty with Canada.

NORTH CENTRAL N. E. L. A. TO MEET.

The North Central (Geographic Division) Electric Association of the National Electric Light Association will hold its next convention in Duluth, Minn., June 21-23, with headquarters at the Spaulding Hotel, T. D. Crocker, Minneapolis General Electric Co., Minneapolis, Minn., is president of the division, and H. E. Young, 15 South Fifth street, Minneapolis, is secretary.

TO LICENSE ELECTRICAL WORKERS.

A bill is to be submitted to the legislature of British Columbia at its present session providing for the licensing of electrical contractors and workers in the interests of better workmanship and safety. Electrical organizations throughout the province have indorsed the proposal, but some opposition is said to be coming from labor unions.

TO REGULATE UTILITY CONTRACTS.

A bill has been introduced in the assembly of the Pennsylvania state legislature authorizing cities, boroughs, towns and townships to enter into contracts with public service companies for a period of not longer than 5 years, without such contracts being subject to the approval of the state public service commission.

ASSOCIATION ELECTS OFFICERS.

The Engineering Advertiser's Association, Chicago, has elected the following officers for the ensuing year: President, Keith J. Evans, Joseph T. Ryerson & Son; vice-president, Julius Holl, Link-Belt Co.; secretary, D. T. Eastman, Eagle-Picher Lead Co., and treasurer, J. B. Patterson, P. H. & F. M. Roots Co.

PUBLIC UTILITY BILL DEFEATED.

By a vote of 18 to 14, the Assembly branch of the State Legislature, Dover, Del., has defeated a bill providing for the creation of a state board of public utility commissioners. The bill as presented provided for the appointment of four commissioners by the governor, each to receive compensation at the rate of $3000 a year, and appropriating $30,000 for operating expenses.

COMING CONVENTIONS.

Kansas City Electrical Show. First annual electrical exposition, Convention Hall, Kansas City, Mo., April 18-23. Manager, Sam Furst, Electrical Trades Exposition Co., 802 Broadway, Kansas City, Mo.

American Electrochemical Society. Spring meeting, Atlantic City, N. J., April 21-23. Headquarters, Hotel Chalfonte. Secretary, Joseph W. Richards, Lehigh University, Bethlehem, Pa.

Missouri Association of Public Utilities. Annual convention, Kansas City, Mo., April 21-23. Secretary, F. D. Beardslee, 315 North 12th street, Chicago.

Wisconsin State Association of Electrical Contractors and Dealers. Spring meeting, Appleton, Wis., April 22. Secretary, H. M. Northrup, 23 Erie street, Milwaukee.

American Washing Machine Manufacturers' Association. Meeting at Sherman Hotel, Chicago, May 18-19. Secretary, Enoch B. Seitz, Otis building, Chicago.

Southwestern Electrical and Gas Association. Annual convention, Galveston, Tex., May 18-21. Headquarters, Hotel Galvez. Secretary, H. S. Cooper, 403 Slaughter building, Dallas, Tex.

American Society of Mechanical Engineers. Spring meeting, Chicago, May 23-26. Headquarters, Congress Hotel. Assistant secretary, C. E. Davies, 29 West 39th street, New York City.

International Railway Fuel Association. Annual convention, Chicago, May 24-26. Headquarters, Hotel Sherman. Secretary, J. G. Crawford, 702 East 51st street, Chicago.

Stoker Manufacturers Association. Annual meeting, Stockbridge, Mass., May 24-26. Headquarters, Red Lion Inn. Chairman of Publicity Committee, R. C. Beadle, 11 Broadway, New York City.

Electrical Supply Jobbers' Association. Thirteenth annual meeting, Hot Springs, Va., May 25-27. Headquarters, The Homestead. General secretary, Franklin Overbagh, 411 South Clinton street, Chicago.

Pacific Coast Geographic Division of the National Electric Light Association. Annual convention, Del Monte, Cal., May 25-27. Headquarters, Hotel Del Monte. Secretary, L. H. Newbert, 445 Sutter street, San Francisco.

National Electrical Light Association. Annual convention, Chicago, May 31-June 3. Headquarters, Drake Hotel. Executive manager, M. H. Aylesworth, 29 West 39th street, New York City.

Tri-State Water and Light Association. Annual convention, Asheville, N. C., June 15-16. Secretary, W. F. Steiglitz, Columbia, S. C.

National Fire Protection Association. Annual convention, San Francisco, June 14-16. Secretary, Franklin H. Wentworth, 87 Milk street, Boston.

Canadian Electrical Association. Annual convention, Quebec City, June 15-17. Secretary, Eugene Vinet, Power building, Montreal, Que.

American Institute of Electrical Engineers. Annual convention jointly with the Pacific Coast convention, Salt Lake City, Utah, June 20-25. Secretary, F. L. Hutchinson, 33 West 39th street, New York City.

North Central Geographic Division of the National Electric Light Association. Next convention, Duluth, Minn., June 21-23. Headquarters, Spaulding Hotel. Secretary, H. E. Young, 15 South Fifth street, Minneapolis, Minn.

Ohio Electric Light Association. Annual convention, Cedar Point, O., July 12-15. Headquarters, Breaker's Hotel. Secretary, D. L. Gaskill, Greenville, O.

National Association of Electrical Contractors and Dealers, Anniversary convention, Buffalo, N. Y., July 20. Secretary, W. H. Morton, 110 West 40th street, New York City.

Illuminating Engineering Society. Annual convention, Rochester, N. Y., Sept. 26-30. General secretary, Clarence L. Law, 29 West 39th street, New York City.

New York Electrical Show, 71st Regiment Armory, Park avenue and 34th street, New York City, Sept. 28-Oct. 8. Manager, Norman Maul, 130 East 15th street, New York City.

COMMERCIAL PRACTICE

New Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

"KILO WATT" PAMPHLETS CONTAIN GOOD-WILL MESSAGES.

Public Relations National Section of N. E. L. A. Prepares Second Series of Booklets Designed for Distribution by Member Companies.

Encouraged by the reception accorded to the first "Kilo Watt" series, and by the manner in which they were accepted by the public reached, a second series of these "Kilo Watt" pamphlets has been prepared under the direction of the Public Relations National Section of the National Electric Light Association. Copy for the second series was submitted at the meeting of the National Executive Committee in Chicago March 15, and many members of the committee went over the material carefully and offered suggestions and criticisms which were adopted.

The National Executive Committee, following a brief discussion relative to the use of the pamphlets and their connection with the National Good-Will Campaign, voted unanimously in favor of continuing the "Kilo Watt" campaign through the medium of this second series. During the course of the discussion it was pointed out that the greatest benefit could be derived from the campaign only when and if all member companies utilize the pamphlets, since the cumulative effect of the National Campaign is many times greater than the same amount of energy and money expended in a similar number of individual local campaigns.

The first series of "Kilo Watt" pamphlets was designed to lay the foundation for the good-will message on financing, regulation, taxation and self-interest contained in the second series of pamphlets, in cases where similar work had not been undertaken. Many of the member companies did not order the first series because they felt that they had covered the same ground in their own campaigns of education previously conducted, but it is expected that practically all of these companies will order the second series and thus participate in the movement to make the National Campaign the greatest possible success.

THE GENIE OF THE BUTTON
KILO WATT Chapter 2
KILO WATT Chapter 1
THE GENIE OF THE BUTTON
KILO WATT Chapter 3
KILO WATT Chapter 6
KILO WATT Chapter 5

Reproduction of Covers of Second Series of "Kilo Watt" Pamphlets.

By comparison with any previous publicity campaign by direct mail advertising either by the N. E. L. A., or any other association, the first series of the "Kilo Watt" pamphlets achieved a smashing success, the extent of which may best be judged from the fact that nearly 7,000,000 of these pamphlets were distributed, reaching more than 1,100,000 electric light and power customers, and, therefore, reaching more than 5% of the country's population.

Already orders have been received, some from companies which ordered the first, and others from companies which did not order the first series, but which desire the second. The members of the Public Relations National Section Executive Committee are definitely behind this movement and are ordering for their own companies. Like the first series, these pamphlets are designed for distribution with consumers' bills, one each month.

UTILITY'S SALES OF ELECTRICAL APPLIANCES COMPARED.

Resume of Merchandise Sales of Pacific Power & Light Co. for 1919 and 1920 Shows Last Year's Record Below the Previous Year.

By J. V. STRANGE,
Assistant General Manager, Pacific Power & Light Co., Portland, Ore.

Comparative figures for the years 1919 and 1920, showing the number of appliances sold and the gross merchandise sales of the electric and gas departments of the Pacific Power & Light Co., demonstrate that from the standpoint of the number of appliances sold, as well as the volume of gross merchandise sales, the record for 1920 did not equal the record established during the previous year. In 1919, 4623 electrical appliances were sold and in 1920 the volume decreased less than 8%, while the number of appliances sold fell off 34%, and this can be accounted for largely because of the fact that fewer of the small appliances were sold in 1920 and all appliances commanded a much higher retail price in 1920 than in 1919. There were more washing machines sold in 1920 than in the previous year and as this appliance is the highest priced article we handle, this, in a large degree, accounts for our success in maintaining the gross volume of sales in the electric department.

In 1919 a special campaign was made, starting in June and terminating in December, during which time a large number of appliances were sold because of special price inducements. This campaign was carried on for the particular purpose of cleaning up an accumulated stock of electrical appliances and resulted in materially increasing the record insofar as the number of appliances sold was concerned. In 1920 efforts were confined along our regular lines.

Another factor that unfavorably influenced the 1920 showing, as compared to the previous year, was the fact that with improved business conditions a number of new appliance dealers started up in business in competition with the Pacific company, and in every town the outlets for the sale of electrical appliances have increased to a marked extent.

A few years ago the company was the only dealer in electrical appliances in many of the communities in which it maintains offices, and few of the local electrical contractors carried a representative line of appliances. Today every town along its lines of any size has an electrical store and the larger communities have several dealers specializing in all kinds of appliances for the use of electricity. Even hardware and furniture dealers carry washing machines and vacuum cleaners, as well as many other electrical devices. This is a condition the company has encouraged through its policy of treating the merchandise business on a plane intended to make it self-supporting and, as a result, it is certain the number of appliances going into the homes of customers has greatly increased.

During the year 1920 three campaigns were conducted of outstanding importance and accounted for a substantial part of the yearly showing. In February a washing-machine campaign resulted in the sale of 228 machines. In October another washing-machine campaign resulted in the sale of 191 machines. As a result of these two campaigns 70% of the yearly sales were accomplished. In April a vacuum-cleaner campaign was put on, which proved to be very satisfactory.

UTILITY GIVES PUBLIC DATA ON CONSTRUCTION PROGRAM.

A double-page advertisement recently published by the San Diego (Cal.) Consolidated Gas & Electric Co., describing the manner in which the company has kept pace with the growing demands of the city and territory served for its electric and gas utilities, stated that during 1920 an expenditure of $1,682,124 was made for necessary construction and that the program for 1921 entails an equally large expenditure including:

$ 300,000	for increased gas production facilities.
275,000	for gas transmission and distribution.
450,000	for electric production.
500,000	for electric ttransmission and distribution.
125,000	for miscellaneous other construction activities.
$1.650,000	

In 15 yrs. the company's business has grown 2500%, as shown in the following comparisons:

	May 30, 1905.	Dec. 31, 1910.	Dec. 31, 1920.
Electric customers	1,205	7,139	27,763
Gas customers	2,090	10,155	27,188
Kilowatts lighting load	1,114	7,308	30,301
Horsepower motors connected	24	2,834	29,906
Total kilowatts connected	1,229	9,422	52,953
Miles gas main	.....	185	532
Miles electric pole lines	.....	150	762
Total miles of wire	.....	840	3,873

UTILITY SECURITIES DESCRIBED IN BYLLESBY BOOKLET.

In a 36-page booklet bearing the title "1921 Investments," H. M. Byllesby & Co., Chicago, describes 30 issues of bonds, notes and dividend-paying preferred stocks, a page being devoted to odd lots. In addition to the Byllesby-sponsored securities there are a number of municipal bonds described. The range throughout the booklet shows yields available in strong dependable public utility and other securities of from 5.75 to 12%. The complete financial and analytical service which the bond department offices and branches have available for investors is covered in a chapter on "Service."

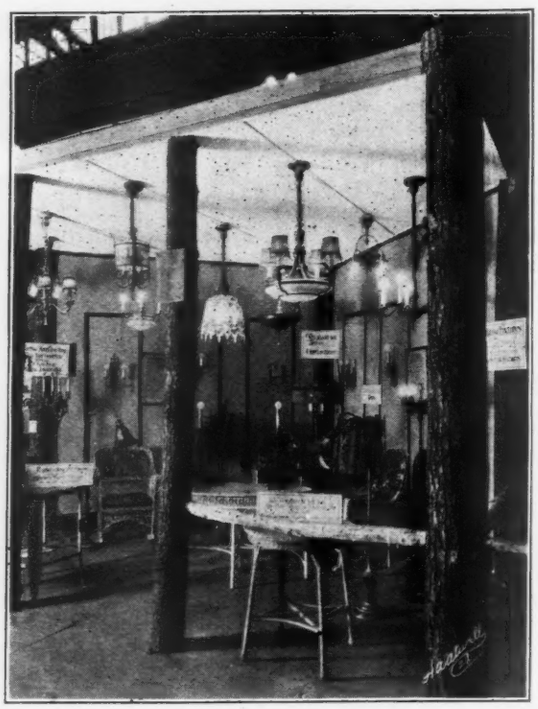
THE FIXTURE MARKET

Items of Interest to Manufacturers, Jobbers and Dealers in Electrical Fixtures, Including Problems of Manufacture and Distribution

FIXTURE MANUFACTURERS DISPLAY ATTRACTS ATTENTION.

Enthusiasm for Good Lighting Equipment Results From Co-Operative Display Made by Chicago Manufacturers.

One of the features of the "Own Your Home" exposition, held March 28 to April 2 in Chicago, was the booth prepared and served by the Chicago Lighting Fixture Council. This display, made by the fixture manufacturers of Chicago, marks the first organized move on the part of the manufacturers of electrical fixtures to advertise the merits



Chicago Lighting Fixture Council Booth at "Own Your Home" Exposition.

of "better fixtures" directly to the consumer. And from the interest attracted by the display it seems evident that the ultimate consumer was more than anxious to learn what he could about "better fixtures."

The spirit of co-operation required to bring together the various manufacturers in a joint effort of this kind speaks for itself. It is impossible to enlist the interests of various individuals in such a co-operative movement without stimulating them all with an added spirit of enthusiasm for their own work, even if no other good were accomplished. But it seems that the enthusiasm of the many visitors to the exposition has been livened as well, and this added interest in good lighting equipment is bound to find expression in a definite and practical way that will please both the home owner and the manufacturer of "better fixtures." A short visit at two or three different times to the booth served to show that people were interested in more than a passing manner, and the questions which they asked made it evident that many of them were prospective purchasers whose buying judgment was being influenced by what they saw.

It is almost needless to say that the fixture manufacturers will be more than pleased with the ultimate results of this effort, and that other displays will be made here and elsewhere. Such education of the public can well be taken advantage of by the dealers in their business relations with their customers—particularly those customers who visited the manufacturers booth. With the "better fixture" idea well established the dealer is no longer forced to sell equipment on the basis of price only, but can offer, with assurance of success, equipment that will prove pleasing to the purchaser and profitable to the dealer.

WHAT IS TENDENCY IN LIGHTING-FIXTURE DESIGN?

Discussion of Factors That Have Influenced Past Practice and That Are Now Shaping the Policies of Designers.

By V. D. Green.

From out of the welter of widely differing basic designs now in use in the lighting fixture field there will undoubtedly emerge one or two basic types which will be distinctively electrical fixture designs founded essentially upon the special advantages and flexibility of electric lighting.

What will they be like? It may be that one guess is as good as another, yet there are certain indications based on the past experiences of the lighting fixture industry which point strongly to the evolution of an almost entirely new type which will combine the artistic merit of what has already been produced with a better lighting efficiency than has hitherto generally been attained in the domestic and commercial lighting fixtures of today.

The lighting fixture industry, as such, is comparatively new. Many of us can remember much of its early history. But the first lighting fixtures may be said to date back to the wonderfully fashioned bronze and iron suspended lamps of the Greeks and Romans. As lighting fixtures they were, of course, somewhat of a failure, but those which have survived show that the craftsmen who made them understood perfectly the necessity of adapting the construction to the lighting medium. Gracefully formed chains of ample length enabled the blazing wick to be placed sufficiently below the point of suspension to eliminate the risk of fire and of "sooting up" the ceiling from which they hung. The overhanging wicks—often four

or six in number—afforded as much downward illumination as could reasonably be expected. Historians also record that these overhanging wicks frequently used to shed oil and pieces of burnt wick over the festive boards they illuminated, but people were not fussy about little things like that in those days. All through the slow evolution from the open dish type of lamps to kerosene burners the same general scheme of design was adhered to.

New Type of Illuminant Introduces New Problems in Fixture Design.

The invention of candles introduced a new set of problems. The source of light was still self-contained, but the bulk of the light was necessarily in an upward direction. Then came gas, and a radical change in construction was again demanded. No longer was the source of light entirely self-contained. It had to be connected to gas mains through pipes. And let us admit that for a long time fixture designers did not rise to the occasion. As a general rule they attempted to combine previous designs into something which would permit the incorporation of the necessary gas-pipes.

Most of us have vivid recollections of the fixtures of that transition period—the weird productions in which one could trace fragments of a dozen styles—which were decorated with meaningless festoons of cheap-looking chains and with imitation candle sconces. It took many years before the gas fixture became a distinctive type.

Precedent Always an Important Factor in Designs of a Transition Period.

Are we not now in the transition period from gas-fixture styles to those distinctively electrical? It is up to the present-day designers to rise to the occasion and to give the public something which is a real *electrical* type; and a new type will be evolved to fit this, the latest and most flexible and adaptable form of illumination, just as surely as other designers have evolved new styles in the past.

Naturally, present-day designers tend to lean somewhat towards the styles which they themselves have evolved in gas-fixture construction. We have for so many years been making both gas and electric fixtures that it is difficult to break away from the old traditions. Now, however, that fully 90% of the fixtures we produce are intended for electricity, is it not time to produce new types which will combine maximum lighting efficiency and artistic beauty?

In endeavoring to forecast the probable characteristics of the coming fixture types a consideration of the inherent characteristics of gas and electric light will offer valuable clues. All style tendencies must necessarily be controlled by these basic characteristics. Gas light can be directed either upwards or downwards, but cannot conveniently be directed in a side-wise direction except by the use of special reflectors. The necessity for providing means of disposing of the heat without fire risk practically restricts the arrangement of the separate burners to one horizontal plane. It is difficult to mass burners one above the other. This consideration of safety from fire also necessitates all ceiling fixtures being provided with fairly long suspension tubes. Pipes must be provided, and since these must be of ample capacity, especially where natural gas of exceedingly uncertain pressure is used, they are difficult to conceal and even where they can be made an essential feature of the design they limit the design to some extent. Lacquers and finishes must be more or less heat-proof or they will deteriorate rapidly. Light units are fairly large—from 50 to 100 cp.

Great Opportunity for Diversity of Design in Electrical Fixtures.

When electricity is used to produce light the light can be utilized in any direction. There are practically no heat troubles, and lamps can be massed in any position. Fixtures can be arranged for indirect, semi-indirect or direct lighting with equal facility. They can be placed close to the ceiling if required. Pipes are not only unnecessary to contain the feed wires, but are positively undesirable and add to the cost of wiring the fixtures. Any lacquer and finish can be used, and any sized units can be installed with the further advantage that separate control for each light is readily arranged for.

From this it would appear that the new fixtures will probably be graceful, tubeless, chain-suspended creations. Possibly they will be of the semi-indirect type with delicately blended colors and lacquering. Probably also fixture makers will press into service many materials which were out of the question in the case of previous illuminants.

As we have said before, one guess may be as good as another, but of this we may be sure: Present-day designers are in no way less skillful than the designers of the past. When the new distinctively electrical types have finally emerged from their present chrysalis form they will be creations of which the fixture industry will be proud.

At any rate there is no doubt that the National Council of Lighting Fixture Manufacturers is fully alive to the possibilities of improving the design of fixtures. The interesting paper and discussion at the recent convention and Fixture Market at Buffalo brought up several new suggestions as to the best method of stimulating design by quickening the interest of designers both within and outside the industry. The more thorough education of the designer in the practical problems of fixture manufacture was recommended, and the best methods of obtaining this result were discussed.

The National Council is proving that its efforts to forward the interests of the lighting fixture industry are directed towards practical ideals.

The report of the thirteenth annual conference on weights and measures of the United States, held in Washington on May 24 to 27, inclusive, has been published by the Bureau of Standards of the Department of Commerce as publication No. 3, and is obtainable for 20 cts. from the Superintendent of Documents, Government Printing Office, Washington. The pamphlet totals 200 pages. The subject matter deals in part with specifications and tolerances of liquid measuring devices and is naturally chiefly of interest to officials in charge of standards and for manufacturers of measures.

QUESTIONS and ANSWERS

All Readers Are Invited to Submit Contributions on Electrical Matters to This Department—Answers Should Be Sent Within Eight Days of Date of Publication of Question—Payment Will Be Made for All Answers Published

Questions.

No. 515.—PRECAUTIONS TAKEN IN GROUNDING LINES AND BUSES.—What precautions are taken to guard against errors in making ground connections in power houses to high-tension cables and buses? Mistakes that have been costly in both life and property have been made, and it is believed that a free discussion of present common practice will be of much benefit. What bus- and line-clip arrangements are used? What locks and hold cards are used? Is it common practice to check connections twice or to have two different men check the connections? Are definite steps taken to see that the ground is maintained even though a mistake has been made?—A. L. T., New York City.

No. 519.—PROTECTING TRANSFORMER POLES NEAR SCHOOL BUILDINGS.—In the safety-first meetings of the company where I am employed the matter of protecting transformer banks near school buildings has been brought up. The proposition is to determine what protection is required to prevent accidents that might result from children climbing the poles. What precautions are taken by other companies to guard against such accidents?—C. W. B., Enid, Okla.

No. 520.—DESIGN OF WINDINGS FOR INDUCTION MOTORS.—Will someone give formulas and examples for determining the proper size of wire and number of turns to be used in winding one, two and three-phase induction motors to operate on 25, 50 and 60-cycle lines at from 110 to 500 volts?—S. M. C., Quebec, Canada.

No. 517.—REFINISHING BRASS TUBING.—Can someone give a good and practical method of refinishing brass tubing and fixture parts? The tubing which I have under consideration at the present time is corrugated.—A. S. N., Plymouth, Mass.

No. 524.—GROUNDING OF STATOR COILS.—I am having trouble with a 75-hp., 3-phase, 60-cycle, 440-volt, 720-r.p.m. slip-ring motor. I have wound this motor and have taken unusual precautions in winding it. Still this motor breaks down to ground at times. It has a voltage test to ground of 2200 volts. The other day one of the coils grounded in spite of the fact that it has been in service not over 3 mo. It received the usual insulating paint, and in addition I put on a heavy coat of weather-proof varnish. It has a good clearance between rotor and stator, does not pull any over load, its running load is 45 to 55 amperes per phase. The motor is used in a glass-manufacturing plant to turn a drum with a chain drive. The drum weighs from 55 to 65 tons, and contains liquid glass. The condition under which it works is this. As this drum revolves it carries the liquid glass up the sides of the drum, and when the contents let go it carries the drum forward faster than the torque of the motor revolves it. Of course this is on only one spot of the revolution. There is also a large amount of vibration, due to the liquid glass slipping off the sides of the drum. The secondary resistance is in good condition, and there are no open leads. Am I correct in assuming that the carrying forward of the rotor faster at times by the drum than the torque would revolve it, has a tendency to puncture the insulation? This last ground I have not examined because I cut out this coil in order that we might continue operation. But previous to this the coils showed a clear burn off of the insulation of three coils at the diamond turns, or rather half way between the end turn and the laminations. The conductors are of standard square wire used for 75-hp. motors. The motor is protected by a circuit-breaker which is equipped with no-voltage and under-voltage trip coils.—C. H. R., Chicago.

No. 525.—UNSTABLE SPEED OF DIRECT-CURRENT MOTOR.—We have several 5-hp., 220-volt, 400 to 1800 r.p.m. adjustable-speed d-c. motors equipped with reverse controller. The motors have commutating poles, shunt coils and compensating coils in slots in the face of main poles. The motors operate properly in both directions up to a point about three steps from the last point. They operate correctly, running clockwise on the last point, having two 40-watt 220-volt lamps in series with field resistance. In the counter clockwise direction the speed of the motor is stable while running on the third point from last, but when advanced to the next point the speed will rise and fall, causing bad sparking across the brushes. The surging gradually becomes of longer periods with increased sparking. The brushes were on the fixed factory position, and shifting them did not help to improve the conditions. The motor was tried with compensating coils cut out, with commutating poles reversed, with armature reversed and with compensating coils reversed, but no improvement resulted. We had no meters to take readings by running the motor as a generator. Would someone please advise me how to get these motors to operate properly?—D. B., Chicago.

Answers.

No. 516.—WINDING FOR THREE-PHASE MOTOR.—I have a four-pole, 220-volt, three-phase induction motor rated at 0.5 hp. and rewound with 24 coils in 24 slots. The coils are arranged and connected as a lap winding. The motor, which was made by the General Electric Co., Schenectady, N. Y., has a squirrel-cage rotor. The coils are connected in one Y circuit, there being two coils per group with 109 turns of No. 20 double-cotton-covered wire per group. The winding pitch is from 1 to 6.

Will someone draw a diagram illustrating the direction of current flow in the windings described above? Considerable trouble is being experienced with heating. It is believed that some of the coils are bucking each other. The full-pitch winding of this motor would be from 1 to 7.—R. J. B., Racine, Wis.

Answer.—A 4-pole 3-phase motor having 24 slots with a span of six teeth may be connected as shown in the accompanying diagram. The large arrows show the direction of flow in each line at

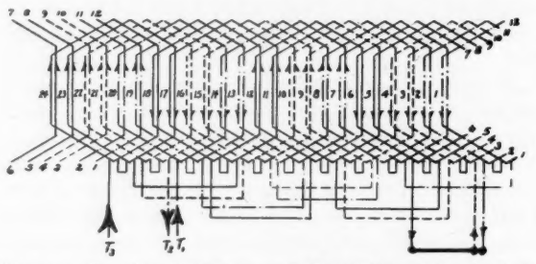


Diagram Showing Winding and Direction of Current in Induction Motor.

a given instant while the small arrows in the slots represent the direction of current in the conductors in that slot at the same instant. The long lines in the slot represent the coil sides in the bottom of the slot (or the top), while the short lines represent the coil sides in the top of the slot (or the bottom).

One way of checking the stator to see if the phases or coils are reversed is to apply a low-voltage direct current from one line to the star point. Two or three dry cells connected in series will give voltage enough for this test. The stator should be placed on its side with the bore vertical. An ordinary compass when held inside the stator near the teeth will locate the poles which should be alternately "North" and "South." These poles

should be marked with chalk, and the "North" poles should be opposite with the "South" poles half way between them.

Each phase should be checked out in turn. If one coil or one phase belt is reversed the center of the poles formed by the direct current will be displaced.—L. M. K., St. Louis.

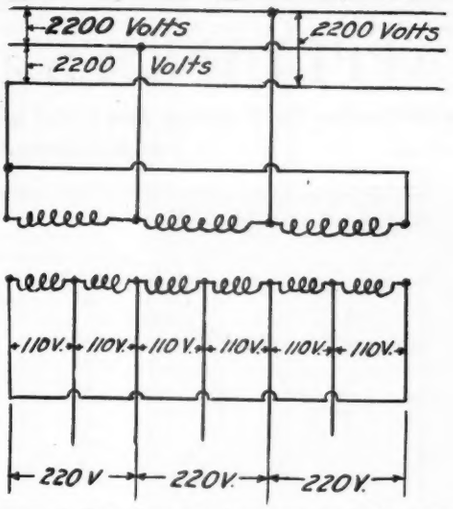
No. 523.—Two Alternators Driven by One Source of Power.—Can two alternators of the same speed and voltage be installed on one shaft, driven by one source of power, and give good results when connected together electrically on the same transmission line? Can they be made to take load in proportion to their rated power by manipulation of the field current in each machine? One of the machines in question is of General Electric make, and is rated at 720 kw., 2300 volts, and 514 r.p.m. The other is a Westinghouse machine rated at 300 kw., with similar voltage and speed ratings.

These machines are now driven by separate twin water wheels with an excessive use of water.—L. J. L., Ausable Forks, N. Y.

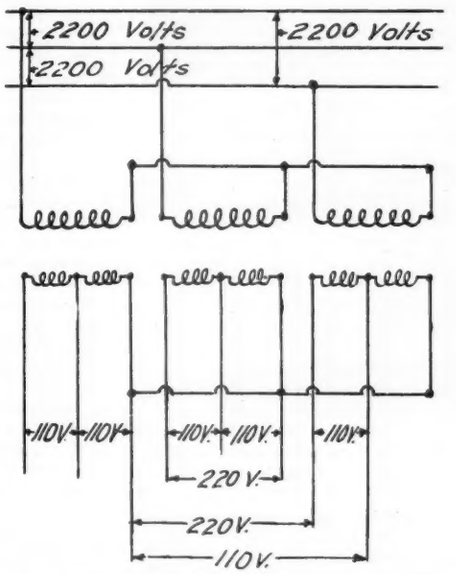
Answer.—The alternators can be connected to the same shaft provided they are of the same voltage, speed and frequency, but the load cannot be properly proportioned by adjusting the field current of the machines. When alternators are connected in parallel the divisions of load depends upon the relation of the position of the field poles to the armature phase windings. The phase relations should be the same as they are when the machines are synchronized, and should be held in this position by the mechanical connections of the shafts. To have the machines take their proper division of load the phase relation of one machine must be shifted with respect to the phase relation of the other machine. This is accomplished by making a slight angular displacement of the field or armature of one machine with respect to the other machine. Such a displacement should be made at full-load on the line, with each machine taking its proper share of the load. Such a position should then be made permanent by proper mechanical provision. The voltage of the line is changed by changing the fields of both of the machines simultaneously. Changing the field of one machine would not make it take any more load but would change the amount of the reactive lagging current flowing between the machines and line. In adjusting the field current the a-c. ammeters should be observed so that at any given load, as read on the wattmeters, the a-c. ammeters should read as low as possible, thus indicating that the wattless current has been reduced to a minimum. Inasmuch as the machines are of different makes and of different capacity the internal impedance of the armature windings will affect the condition to some extent, and it may be necessary to adjust the fields more or less for different load conditions so as to avoid large values of wattless current.—H. D. W., Milwaukee, Wis.

No. 509.—Connecting Single Transformers in a Three-Phase Bank.—I have three single-phase, 5-kv-a. Westinghouse transformers, rated at 2200 to 220 and 110 volts, and want to know if I can use them connected together on a three-phase circuit and get 220 and 110 volts on the secondary side. If so, will someone please explain how to connect them and make a simple diagram for a guide?—R. L. G., Reynolda, N. C.

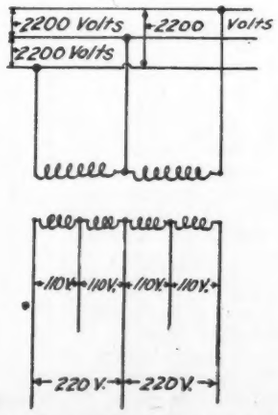
Answer.—Three schemes for obtaining a three-wire, single-phase connection are shown herewith. The first is a bank connected delta-delta, the second is star-star connected and the third, involving the use of two transformers only, is connected in V or open delta. In each case the phases must be interconnected externally and loaded so as to produce as nearly a perfect balance between phases as possible.—J. S., Cumberland, B. C.



Bank of Transformers Arranged in Delta-Delta Connection.



Bank of Transformers in Star-Star Connection.



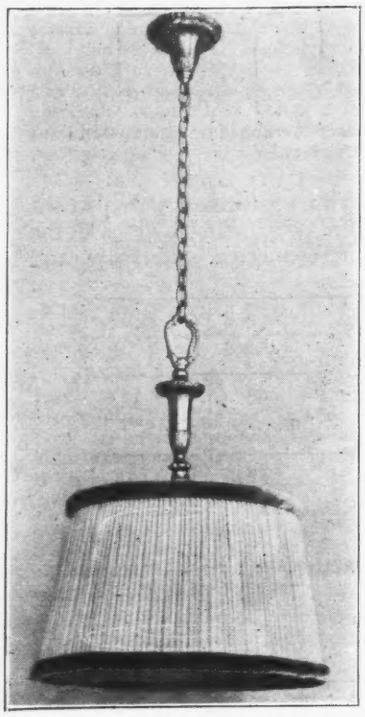
Two Transformers Connected in V or Open-Delta.

APPLIANCES and DEVELOPMENTS

New, Improved or Interesting Electrical and Mechanical Apparatus and Devices, and Applications of Equipment and Methods in Practice

"T. R. B." Lighting Unit Adapted to Various Uses.

The "T. R. B." lighting unit, made by the Mitchell Vance Co., 503 West 24th street, New York City, is said to be the result of the practical application of



Lighting Fixture Combining Beauty With Good Illumination.

scientific principles in the diffusion and distribution of light, and not a novelty or a freak shape designed simply to be different. The form of the globe was determined on the basis of a knowledge of the diffusion of light rays; the result is said to be a triumph in the distribution and volume of light over the working plane and a revelation as to the quality of light necessary to conserve the human eye.

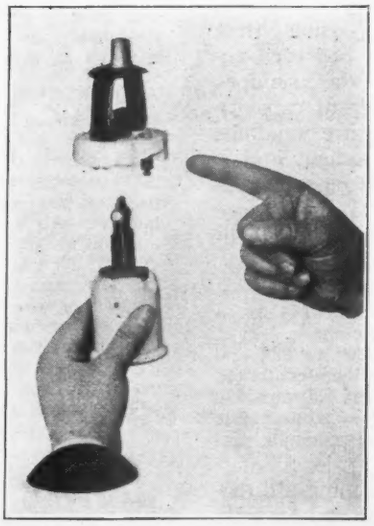
The following distinct features are worthy of careful consideration: The flat wide top creates a softly diffused light over a wide area on the ceiling without the presence of shadows or light rings; the large flat surface in conical form creates low intrinsic brilliancy and gives softly diffused light to the walls; the angular inward under portion in low brilliancy avoids glare and helps to distribute light over the working plane in a wide area; the convex centre, or bulls-eye, in the under part concentrates and distributes the maximum illumination over the working plane, and the downward light by reflection from various planes inside of the globe helps to create additional diffused light on the working plane.

Due to the particular construction of the glass, which is the famous Celestialite glass made in special "T. R. B." density, it is possible to do delicate work with the same precision and certainty as in actual daylight without injury to the eyes. The unit is made in four sizes for use with 75, 100, 150, 200, and 300 and 500-watt type C lamps. It is made perfectly plain for use in stores, office buildings and industrials. It is also made decorative for use in the home, club or hotel. It is dust proof and properly ventilated, and is packed complete in individual cartons of convenient weight and size for ease in handling. A novel switch arrangement has been perfected to fit all canopies where individual control is desired.

Automatic Cutout for Incandescent Street Lighting.

Since the establishment of series incandescent street lighting as an economical means of city illumination, there has been a demand for a simple, sure working cut-out. Different forms have been tried with various success, all built around the principle of the voltage puncturing a specially treated insulator when the current ceased to flow through the lamp filament. The principle has never been at fault but the mechanical means of realizing it have been at times crude and unfinished.

The General Electric Co. has developed and is today marketing a magazine cut-out which, it is stated, overcomes the objections to the older styles. It consists of a capsule containing a roll of dielectrically treated fabric. This compact, waterproof capsule is inserted in the opening between the clips of a standard G-E series socket. A short length of the fabric is first drawn out of the capsule between the clip faces. When a lamp burns out the film at once punctures closing the shunt circuit, and



Magazine Film Cutout in Standard Series Street Lamp Receptacle.

allowing the other lamps to burn on without interruption. The old device very often punctured cutting-out the lamp without cause, or refused to puncture at the right time, thus plunging a section of the city into darkness.

Renewal by the lineman is a simple matter with the new cut-out. He removes the socket, separates the clips and

Replacing Lamp After Renewing Magazine Film Cutout.

pulling out the punctured section of film tears it off. His fingers, often oily and dirty, never come in contact with the new section of film which has been pulled into place. There is no groping in the pockets for the old insulating discs or rings often rendered useless by dampness or dirt, nor is there the temptation to insert a bit of tape, a match or other foreign substance between the clip faces when the right material is not at hand, a procedure which in the past has often raised havoc with lighting circuits.

Another marked advantage of the new magazine film cut-out is its exceptionally long life. Allowing three burned-out lamps a year, the cut-out with its 15 dielectric surfaces is good for 5 yrs. service.

A New Development in Indirect Lighting.

Indirect lighting has experienced many changes, having passed through both prosperous and dull periods in the course of its development; suffering eclipse and enjoying approval in a way reminiscent of the vagaries of fashion. However, did it possess only the merit of novelty it would long since have vanished. The method of lighting directly has intrinsic worth. The popularity of the many indirect and semi-indirect units now on the market is evidence of this. Constant efforts are

being made to reduce the brightness of lighting units, specification limits are being made more stringent and the general public are demanding softer appearing units. All this is forcing designers to concentrate more and more on indirect lighting.

Illumination from a totally indirect unit presenting a dark, opaque undersurface, contrasting with the brightly illuminated ceiling, is a passing phase

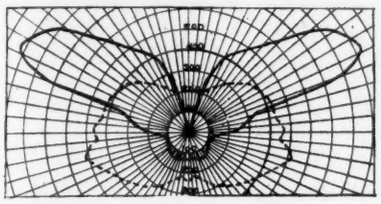


Fig. 2.—Distribution of Light From "Apollo" Unit With 300-Watt Lamp.

in the exploitation of indirect methods. The undesirable nature of the effect of the black outside when viewed against the lighted background is now admitted, so that today such units have their outside illumined (sometimes by means of a secondary source, or by diffusion upwards from bottom plates or cups). There is thus an effort to affect a compromise between indirect and semi-indirect methods. It is along this line that, broadly speaking, fixture engineering and design should logically move.

A unique example of progress in this direction is that evidenced by the "Apollo" lighting unit, the latest offering of the Holophane Glass Co., 340 Madison avenue, New York City. It is an indirect lighting unit with luminous bowl; "indirect" by virtue of the fact that only 14% of the lamp output is emitted directly below the horizontal from the unit, the remaining 70-72% going to the ceiling. Distributed over the large area of the outer bowl, the small direct component results in low brightness. To be specific, 2.6 candles per square inch, is the maximum figure. This is about the same as sky brightness.

Another feature lies in the use of two bowls with different optical qualities for the purpose of producing a fading spot on the ceiling. Heretofore indirect lighting units have thrown a comparatively narrow, well-marked spot. This new unit throws a wide spot, even when mounted within 12 ins. of the ceiling, that shades away so that there is no marked limit. It accomplishes this in the following manner. The inner bowl (see Fig. 1) acts as an extensive reflector, throwing a definite spot, as do such reflectors, but wider than usual. The outer bowl receives the uncontrolled light from the inner reflector and sends it up to the ceiling about the edge of the spot, wiping it out.

It is obvious that the smaller the area onto which the light flux from a unit is delivered on the ceiling, the greater will be the utilization of the flux on the working plane. The ideal in this direction would be a point source located on the ceiling. But the intrinsic brilliancy of such a source would be too great. It therefore becomes an engineering problem of considerable nicety to strike such a balance that a wide, gradually-fading ceiling spot shall be thrown, and have at the same time enough light concentrated above the unit to give effective utilization on the working plane. The distribution curve shown in Fig. 2 will illustrate the degree to which the designers have been successful. The low intrinsic brilliancy of the luminous bowl makes this unit suitable for the lighting of schools, offices and all locations where similar requirements obtain. The successful effort of its designers to give the bowl and ceiling about the same brightness (which really marks a big step in advance in lighting fixture engineering) should make this unit excellent for such situations.

The modern practice of standardization has been carried so far in this unit that the same fixture can be used as either a ceiling or suspension unit, the change from one to the other being affected very simply. Different sizes of lamps in the same unit are taken care of by means of adapters. Adjustment to different sizes of structural bays is also arranged for. In the ceiling unit a movable nipple permits the lamp to be raised or lowered independently of the fixture; and in the suspension unit the length of the chain or cord support can be varied to accomplish the same purpose. All glass surfaces exposed to the air are smooth. The space between the two bowls shown in Fig. 1 is sealed at the top with a white enamelled dia-

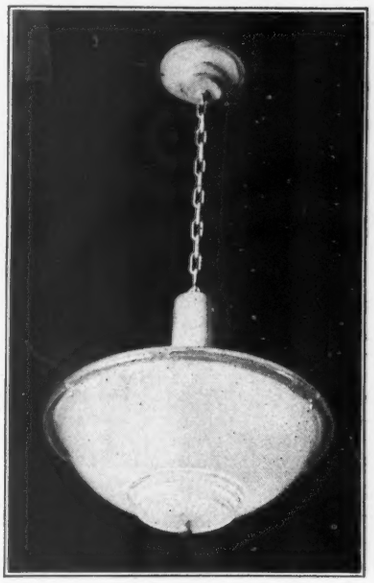


Fig. 3.—"Apollo" Unit With Both Reflecting and Refracting Glassware.

phragm and at the bottom with the finial. The prismatic surfaces are therefore protected from dirt accumulations, making the unit dust-resisting. The inner bowl can be wiped out and lamp renewals made without removing any part of the unit. The reflecting and refracting material used, being crystal glass of the highest grade, is permanent in its nature, and not susceptible to deterioration. For a practical life such as 10 yrs., the same is also true of the fixture materials.

A decidedly striking innovation is the use of color filters in this unit for the purpose of giving the luminous bowl any desired hue. The "filters" are made of silk and similar fine mesh materials, and are placed around the inner reflectors in the form of outside covers. The transmitted light takes the hue of the filter and "paints" the outer bowl delicately. This will permit the mistress of the house to match her lighting "furniture" with her household furniture, and make seasonal changes. Mention should be made of the enhanced appearance of the unit when used with parchment or silk shades. The unit will take standard 12 or 16-in. shades, which can be suspended from the rim. As most of the light is delivered to the ceiling by the inner reflector very little is lost by absorption in the decorative shades.

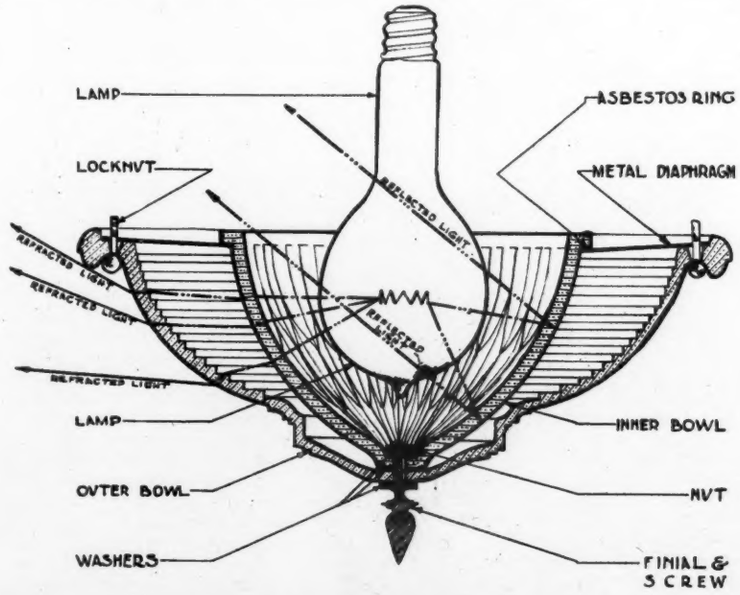


Fig. 1.—Diagram of An "Apollo" Unit, Showing Various Parts and Light Paths Through and From the Refracting and Reflecting Elements.

Controlling the Lights Used in Moving-Picture Studios.

A new departure in the control of large arc lights in moving-picture studios is embodied in a studio arc lamp made by the Display Stage Lighting Co., Inc., New York City, and shown in the accompanying illustrations. The control of the arc is accomplished by means of a resistance box which is mounted on

the base at the bottom of the lamp standard. The switch equipment on the resistance box consists of a double-pole knife switch and two circuit-breakers, which are shown in one of the illustrations.

The switches and resistances are made by the Cutler-Hammer Manufacturing

Switch Panel With Cover Removed.

Co., Milwaukee. The equipment is operated by first closing the knife switch, which connects the arc lamp in circuit with the resistance. The latter allows a current of 50 amperes to flow, which is sufficient to cause the arc to glow. Either one of the two circuit-breakers is then closed, shunting part of the resistance and increasing the current to 100 amperes. Closing the second circuit-breaker further increases the current flow to 150 amperes. Should the arc fail to maintain itself or the current supply be shut off, the circuit-breakers will trip out, thereby cutting all the resistance into circuit. Upon return of the current, which will be indicated by the glow of the arc, 50 amperes will be maintained until the circuit-breakers are closed to increase the current to 100 and 150 amperes respectively.

The switch equipment and resistance are completely inclosed to prevent persons coming in contact with live parts. The switches and terminals are exposed by removing the sheet metal cover,

Arc Lamp Used in Moving-Picture Studios With Control Resistance.

which is accomplished by taking out four screws. The entire equipment is made very compact and readily portable by the method of carrying the resistance box and the lamp mounted together on the same base.

Precision Wavemeter for Radio Signal Sets.

A precision wavemeter with a range of from 75 to 24,000 meters has been placed on the market by the General Radio Co., Cambridge, Mass. The instrument consists of a condenser, inductance, and thermo-galvanometer all connected in one circuit. The condenser is of the Type 222 precision condenser with a capacity of 1500 microfarads. The inductance coils are wound with stranded wire with the separate strands insulated from each other. Five coils are used to cover the range of 75 meters to 24,000 meters. Resonance is indicated by means of a Weston thermo-galvanometer mounted in the top of the condenser case. The five inductance coils are inclosed in mahogany boxes on which are mounted bakelite panels. The mounting posts of the coils are so arranged that they will fit on to the connecting bars in only one way, so that the coil always will be connected in the same manner in which it was calibrated. The condenser is mounted in a polished mahogany case.

Radio-Luminous Device for Push Switches and Sockets.

A new type of radio-luminous pendant on "Paiste" pull sockets has recently been placed on the market by the Hart & Hegeman Manufacturing Co., Hart-

"H & H" Push Switch With Luminous Button Insert.

ford, Conn. The object of this device is to eliminate the inconvenience of groping around in a dark room to find the socket chain for turning on the electric light. The "Paiste" sockets are

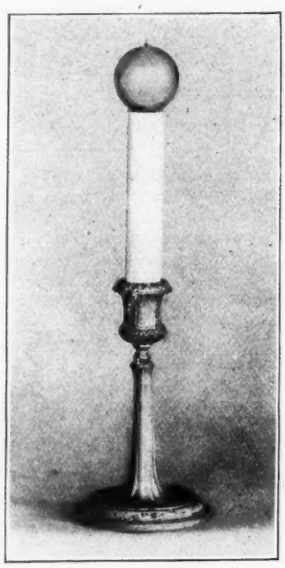
"Paiste" Pull Socket With Radio Pendant.

equipped with radio-glowing pendants which are permanently fastened to the pull socket chain. The pendants can also be furnished separately to be attached to sockets, pull switches, etc., already installed.

In the hotel or apartment building switches with luminous buttons are desirable. In case of fire, sickness or other emergency, light is the first thought, and in such cases a luminous-button switch is an advantage. In line with this idea the Hart & Hegeman Manufacturing Co. has equipped its "H & H" push switches with radio-active luminous button-inserts, as depicted in the illustration.

An Electric Candlestick Made of Metal.

An electric candlestick suitable for use on the dining room buffet, the living room mantel, or in the boudoir, is



Findlay Electric Candlestick No. 610.

being placed on the market by the Robert Findlay Manufacturing Co., 224 Fifth avenue, New York City. This device is made entirely of metal and finished either in Etruscan gold or Colonial silver and ivory.

New Design of Electric Furnace for Steel Forgings.

An order for a new design of electrically heated car type annealing furnace for heat treatment of large steel ingots and forgings has been secured by the Electric Furnace Construction Co., 908 Chestnut street, Philadelphia, from the Sociedad Espanola de Construccion Naval, Madrid, Spain. It is stated that this will be the largest electric furnace in the world for this particular class of work, and the dimensions are 6800 mm. long by 4750 mm. wide by 4140 mm. high, and will heat a charge of 60 tons of steel to 1700 deg. F. every 24 hrs.

The Electric Furnace Construction Co. has already supplied the same company with an electrically heated furnace 36 ft. deep by 12 ft., outside diameter, for heat treatment of gun and large forgings. The heat regulation on both furnaces is entirely automatic in regulation and a predetermined heat of within 5 deg. plus or minus can be secured.

It is stated that furnaces of this type offer a big field for the power-supply companies, as they have a unity power factor and usually are operated continuously. Under such conditions it will pay power suppliers to give special rates and the furnace user should also bear in mind that such electrical installations will bring up his power load factor and often insure a better rate for all his power.

ACTIVITIES IN THE TRADE

Business Developments, Sales Agencies, Trade Literature and Miscellaneous Items Concerning Electrical Manufacturers and Allied Business Interests

Universal Crane Co. has moved its plant from Cleveland to its new factory building at Elyria, O.

Schimmel Electric Supply Co., 526 Arch street, Philadelphia, has filed plans for alterations in its building.

Harvey Hubbell, Inc., Bridgeport, Conn., has issued catalog No. 17 covering its line of electrical specialties.

The Huron Electric Co., Buffalo, N. Y., manufacturer of electrical apparatus, has increased its capital stock to $30,000.

United Electric Products Co., New York City, has leased property at 22 West 17th street for a new local establishment.

Pierce Brothers Electric Supply Co., Tampa, Fla., plans to erect a building at 206 Franklin streeet at an estimated cost of $22,000.

Spilger Electric Co., 109 Barclay street, New York City, electrical products, has filed notices of increase in the capital stock to $50,000.

Duplex Electric Co., New York City, manufacturer of electrical equipment, has filed notice of increase in its capital stock to $125,000.

Burnett-Larsh Manufacturing Co., Dayton, O., has issued its dealer catalog No. 3, revised, covering "Duro" pumps and systems for residence water supply.

Connecticut Blower Co., Inc., Hartford, Conn., has had plans prepared for the erection of a manufacturing and foundry building at an estimated cost of $62,500.

W. G. Nagel Electric Co., 30 St. Clair street, Toledo, O., has issued its motor list No. 29 containing prices and data on new and remanufactured motors and generators.

American Thermostatic Co., 19 East Sixth street, Charlotte, N. C., of which C. L. Brookshire is president, plans to establish a plant for the manufacture of thermostats and other precision devices.

Harry Sidur, proprietor of the Utica Electrical Shop, 208 Utica avenue, Brooklyn, N. Y., has issued two small blotters on which appear illustrations of the effect of good lighting in the home by the use of Edison mazda lamps.

H. G. McFaddin & Co., 38 Warren street, New York City, has recently issued a booklet on its lighting units, which illustrates and describes the "Mefcolite" semi-indirect fixtures, the "Mefco" screwless holders, clusters, electrical fittings, etc.

Robert Findlay Manufacturing Co., Inc., 224 Fifth avenue, New York City, manufacturer of illuminating fixtures of brass and Etruscan bronze, has prepared for the information of the jobber and dealer a 104-page catalog containing an illustration and condensed description of each style and type of fixture made by the company.

Henkel & Best, 122 South Michigan avenue, Chicago, manufacturers of lighting fixtures, have purchased the plant of the Lincoln Brass & Spinning Works, 3262 West Grand avenue, Chicago.

Wagner Electric Manufacturing Co., St. Louis, has issued a miniature of its regular 8 by 10.5-in. bulletin, which contains data on the various types of transformers manufactured by the company.

Fuller-Lehigh Co., Fullerton, Pa., has issued bulletin No. 600 entitled "Pulverized Coal for Boilers." It consists of 28 pages and contains illustrations and data on various pulverized-coal installations.

Hazelton Motor Supply Co., Hazelton, Pa., is being organized by Harry Benjamin and associates to manufacture and deal in electrical equipment. Application for a state charter will be made at an early date.

Westinghouse Lamp Co., 165 Broadway, New York City, has issued the first number of its new house magazine entitled "Light Touches." Its purpose is to deal with the activities of its "A" and "B" agents and its lighting, service and engineering activities.

Electric Construction Co., 182 East Sixth street, St. Paul, Minn., has announced a change in name to the Commonwealth Electric Co. The old organization will remain unchanged, it is stated. The company has also opened a retail store for the sale of electrical appliances and wiring materials.

Gillinder & Sons, State and Devereaux streets, Philadelphia, held during the month of March an exhibit of its glassware products at the Hotel Imperial, New York City. The display consisted of complete sets of bowls, balls and shades of decorated and etched emalite, decorated alabaster glass, etchings and colors filled in on alabaster glass, silver etchings and cuttings.

Luminous Unit. Co. Division of the St. Louis Brass Manufacturing Co., St. Louis, has issued two booklets on "Brascolite" lighting fixtures, one of which contains illustrations of this type of fixture for display rooms, hotels and clubs, railway stations, banks, churches, offices and schools. The other booklet is devoted to the various types of "Brascolite" fixtures for the illumination of hospitals.

Ivanhoe-Regent Works of General Electric Co., Cleveland, has issued a 16-page booklet, bearing the title "The Ivanhoe Booster Book," in connection with its store, factory and home-lighting campaigns. The booklet contains reproductions of advertisements which the company is running in the electrical papers, telling the story of good lighting. Suggestions for window trims and other dealer-help material are also given.

Benjamin Electric Manufacturing Co., Chicago, has issued bulletin No. 17, consisting of 88 pages and bearing the title "Benjamin Industrial Lighting." The company states that the bulletin is a new Benjamin contribution to the progress of correct industrial lighting and contains practical information and complete data for applying the principles laid down by illuminating engineers as the best practice in the lighting of buildings and areas devoted to industrial uses.

Laundryette Manufacturing Co., maker of the Laun-Dry-Ette, has announced the recent publication of the first number of its new sales bulletin as the "Dryer." This bearer of advertising and selling ideas will be sent from time to time to each Laun-Dry-Ette dealer. It is a multigraphed affair and takes its name from the dryer, a built-in device on the Laun-Dry-Ette electric washing machine, which enables the user to entirely dispense with a wringer. The dryer whirls the wet clothes "wringer-dry" in 1 min. without handling or loss of buttons.

General Electric Co., Schenectady, N. Y., has issued a 16-page illustrated booklet descriptive of electrical equipment for movable highway and railway bridges. In operations of this kind both a-c. and d-c. equipment is utilized. According to the booklet, the electrical equipment for the different types of bridges is much the same. In the booklet the details of the equipment described include the main operating motors, solenoid brakes, emergency brakes, controllers, resistors, lock motor, limit switches, etc. The bulletin also describes the various types of bridges, such as swing span, draw, vertical lift and bascule bridges.

Nordberg Manufacturing Co., Milwaukee, has issued a descriptive booklet entitled "Nordberg Diesel Engines," and known as Bulletin No. 31, which contains photographic and diagrammatic illustrations showing the three types and features of Nordberg Diesel engines. A number of the views depict the Nordberg Diesel engines driving generators and air compressors. The booklet gives some space to the fuel-oil situation, the requirements of a Diesel engine and the principle of the 2-cycle engine. It then points out the distinct features of the Nordberg engine, describes the different types and parts and gives information relative to fuel consumption, speed regulation, auxiliary equipment, cooling water and operation at high elevations.

PERSONAL MENTION

Biographical Sketches and Chronicle of Changes in Business Connections, Promotions and Other Personal News of the Industry

TATE G. GLENN has been appointed service manager of the Consumers Light & Power Co., Ardmore, Okla.

OSCAR A. KNELL has been appointed plant superintendent of the Tri-State Telephone & Telegraph Co., with headquarters at St. Paul, Minn.

G. GORDAN GALE, president and general manager of the Hull (Que.) Electric Co., has been elected president of the Canadian Electric Railway Association.

E. R. WETZEL has been elected general manager of the Colorado Fuel & Iron Co., Denver, Colo., to fill the vacancy caused by the death of J. B. McKennan.

ROBERT F. HERRICK, Milton, Mass., has been elected a director of the Submarine Signal Co. He was formerly president of the Reed-Prentice Co., Worcester, Mass.

JAMES R. LOWE, formerly sales engineer with the Midwest Engine Co., Anderson, Ind., has been appointed general sales manager of the Harrisburg (Pa.) Foundry & Machine Works.

D. M. MULCAHY has been appointed New England representative of the Hero Pipeless Furnace Co., Chicago, and has established an office at 219 Pearl street, Hartford, Conn.

PAUL P. HAYNES, Anderson, Ind., has resigned as a member of the Indiana Public Service Commission and plans to engage in the practice of law in Indianapolis in the near future.

GEORGE W. QUENTIN, formerly an electrical engineer with the Westinghouse Electric & Manufacturing Co., has become connected with the Duquesne Light Co., Pittsburgh, as a power solicitor.

L. F. MERRITT has resigned as consulting engineer of Joseph N. Smith & Co., Detroit, to devote his time as secretary and treasurer of the Wright-Fisher Engineering Co., located in the same city.

FRANK H. FREEMAN has been appointed general sales manager of the Illinois Wire & Cable Co., Sycamore, Ill., manufacturer of weatherproof wire. He was formerly connected with the Anaconda Copper Mining Co.

A. E. DYMENT has been elected president of the Canadian General Electric Co., Ltd., Toronto, Ont., to succeed Frederic Nicholls, who becomes chairman of the board of directors. J. J. Ashworth was elected general manager.

JOHN F. LAYNG, who was formerly connected with the railway and traction engineering department of the General Electric Co., has become a member of the consulting engineering firm of Hemphill & Wells, New York City.

F. O. KIRKPATRICK has been elected vice-president and sales manager of the Master Electric Co., Dayton, O. For the past 12 yrs. he has been in charge of the industrial division of the Cincinnati branch of the Westinghouse Electric & Manufacturing Co.

FRANK T. GROOME has completed his work undertaken in connection with the industrial lighting campaign of the Electrical League of Cleveland, and has returned to Toronto. He was invited to Cleveland by the Erner Electric Co. to aid in organizing and

F. T. Groome.

in carrying on a city-wide campaign of education among industrial plant executives, and as a member of the Industrial Lighting Committee of the Electrical League his work was very effective. Mr. Groome is best known as an organizer of the Ontario Association of Electrical Contractors and Dealers in Toronto. Later he organized both the electrical jobbers and manufacturers of Canada.

G. C. DERRY has been placed in charge of the fuel economizer and mechanical draft department of the B. F. Sturtevant Co., Hyde Park, Boston. He was formerly district manager of the power apparatus department of the New York office.

CHARLES J. STAR, who was formerly in charge of the planning and engineering department of the New Britain (Conn.) Machine Co., has been appointed assistant superintendent of the machine laboratory in the engineering department of the University of Illinois at Urbana, Ill.

WILLIAM R. CALDWELL, formerly with A. S. Schulman and the Chicago and Northwestern Railway Co., has joined the staff of the Norwood-Noonan Co., 116 West Illinois street, Chicago, contracting electrical and mechanical engineer. He will handle industrial and railway electrical installations.

DR. ERNEST FOX NICHOLS, former president of Dartmouth College, has been elected president of the Massachusetts Institute of Technology to succeed the late Dr. Richard C. MacLaurin. Dr. Nichols will take office July 1. He has been a professor of physics at Yale University and has been engaged in private research work for the past year.

COL. ROBLEY S. STEARNES, president of the Standard Electric Construction Co., electrical engineer and contractor, 336 Camp street, New Orleans, La., has been elected president of the Contractors' and Dealers' Exchange of New Orleans. He is a past president of the National Association of Electrical Contractors and Dealers and a member of the executive committee of that organization.

OTTOMAR H. HENSCHEL, who was at one time engaged in engineering work for the Sheboygan Railway & Electric Co., and later was superintendent of power plants for the Central Illinois Light Co., Peoria, Ill., has resigned his position as associate editor on the staff of *Power Plant Engineering*, Chicago, to become associated with Deane S. Holt of Milwaukee, in the Holt Power Equipment Co. This company, which up to the present time, has been specializing in the purchase, sale and reconstruction of electric generators and motors, will hereafter, in addition to its present activities, engage in electrical engineering, construction and maintenance work, particularly in connection with industrial light and power installations.

OBITUARY.

W. F. REYNOLDS died recently at Quincy, Mass., at the age of 51 yrs. He had been connected with the engineering firm of Lockwood, Greene & Co., Boston, for the past 30 yrs.

JOHN M. STARR died recently at East Hampton, Conn., aged 75 yrs. He was an official of the Starr Brothers' Manufacturing Co., treasurer of the Pocotopaug Water Power Co., and a director of the Middletown Trust Co.

DR. THOMAS B. DOOLITTLE, of Branford, Conn., pioneer telephone engineer, said to have originated the telephone switchboard, and associated in the organization of the original Bell telephone company in Boston, died in the Peter Bent Brigham Hospital, Boston, April 4. He was 82 yrs. old and was born in Woodbury, Conn. Early in life he was a manufacturer of brass articles in Bridgeport, Conn., and made many inventions in the manufacture of barbed wire. In 1898 he received the Edward Longstreth medal from the Franklin Institute of Philadelphia for origination of the process of producing hard-drawn copper wire. He retired from active service with the American Telephone & Telegraph Co. in June, 1919. He is survived by two daughters, and one son, Charles B. Doolittle, secretary and treasurer of the Southern New England Telehone Co. of New Haven, Conn.

BUSINESS OPPORTUNITIES

News of Electrical Construction Projects in All Parts of the Country, Proposals Invited, Foreign Trade Openings and New Companies

EASTERN STATES.

Clarendon, Vt.—The Vermont Hydro-Electric Corp. is arranging for greater output at its generating plant to provide for the anticipated industrial load in this section with the resumption of operations at the different factories.

Rutland, Vt.—The Rutland Railway, Light & Power Co. is standardizing its lines in the vicinity of Wallingford, Vt., on a 60-cycle frequency instead of 25-cycle as heretofore used. A number of motors and other electrical equipment are being installed in the various industrial plants to provide for the change.

Holyoke, Mass.—The Lyman Mills have awarded a contract to the Swan Rigging Co., 145 State street, Springfield, Mass., for the installation of a new 2500 kw. turbogenerator and auxiliary operating equipment at the power plant at their cotton mills.

New Bedford, Mass.—Electric equipment will be installed in the 3-story addition to be erected at the plant of the Snell & Simpson Biscuit Co., Adams street. Plans for the factory have been filed.

Pittsfield, Mass.—The General Electric Co. is installing a new 2500 kw. turbogenerator at the power plant at its local factories, with auxiliary operating equipment for increased output.

Springfield, Mass.—The United Electric Light Co. has awarded a contract to the Adams & Ruxton Construction Co., Springfield, for the installation of underground conduits in Carew and Liberty streets, Page boulevard and neighboring thoroughfares, totaling about 300,000 duct ft. The installation will be completed during the coming spring and summer seasons.

Providence, R. I.—The Penal and Charitable Commission will soon make application to the General Assembly for an appropriation of $80,000 for the installation of electric light and power equipment at the state prison.

Binghamton, N. Y.—The Achilles Rubber & Tire Co. is arranging for the installation of increased electric equipment to bring up its power load to 2400 hp. Service will be furnished by the Binghamton Light, Heat & Power Co.

Buffalo, N. Y.—Considerable electrical and mechanical equipment will be installed in the flour mill to be constructed at the foot of Louisiana street by the Standard Milling Co., 49 Wall street, New York City, estimated to cost close to $9,000,000. The installation, as proposed, will require about 16,000 hp., and this will be furnished by one of the local public utilities. The A. E. Baxter Engineering Co., Ellicott square, is engineer for the work.

Buffalo, N. Y.—Considerable electrical and mechanical equipment will be installed at the proposed filtration plant to be eercted by the city in the vicinity of Porter avenue. Public Works Commissioner Arthur W. Kreinheder has presented details and recommendations regarding the project to the City Council. The plant is expected to cost close to $4,000,000.

Georgetown, N. Y.—The Georgetown Electric Lighting Co. has been incorporated with a nominal capital to operate a local light and power system. The company is headed by C. D. Brown, A. A. Watson and E. L. Andrus.

Mt. Vernon, N. Y.—Electrical and mechanical equipment will be installed in the 1-story and basement addition to be constructed by the General Optical Co., 256 Washington street, estimated to cost $75,000. Bids will be asked at an early date.

New York, N. Y.—The United Electric Light & Power Co., 130 East 15th street, has awarded a contract to James A. Henderson, 103 Park avenue, for the erection of its proposed 3-story electric substation at 115 West 98th street, 30 by 100 ft., estimated to cost $170,000.

New York, N. Y.—The Frank A. Munsey Co., publisher, has awarded a contract to the New York Edison Co. for service for the operation of the new plant of the paper, to be located at 7th avenue and 16th street. An isolated plant now in the building will be discontinued. The installation will comprise 1600 lamps and about 600 hp. for printing presses, house pumps, ventilating systems, etc.

New York, N. Y.—Electrically operated hoisting and conveying machinery, loading and unloading equipment, etc., will be installed by the Pouch Terminal Co., 17 State street, New York City, at its new 7-story freight terminal at Clifton, S. I.; a similar building will also be erected by the American Dock Co., same address, an affiliated organization at Tompkinsville, S. I. The Turner Construction Co., 242 Madison avenue, New York City, has the building contract.

Potsdam, N. Y.—The St. Lawrence Transmission Co. has filed notice of increase in its capital stock from $3,250,000 to $4,000,000. The company has plans under way for the construction of a number of extensions in its system at Tupper Lake and vicinity. F. A. Stroughton is president.

Sharon Springs, N. Y.—The J. H. Gardner Estate will build a power house in connection with a number of bath-houses at other buildings at its local properties. The work is estimated to cast $40,000. Morrill Vrooman, 3 North Main street, Gloversville, N. Y., is architect and engineer.

Atlantic City, N. J.—The City Commission has awarded a contract to Wilbert Beaumont for the erection of a building for the city electrical bureau in the rear of the City Hall, estimated to cost in excess of $25,000.

Camden, N. J.—Electrically operated freight handling equipment will be installed in the 1-story freight warehouse to be erected by the Harbor Commission, George N. Bradley, chairman, at Spruce street and Delaware avenue, estimated to cost $136,000.

Lakehurst, N. J.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning the installation of an electrically operated pumping plant at the local aircraft works.

Newark, N. J.—A 1-story power house will be erected by the Newark Cleaning & Dye Works at its new plant at 9-13 Beacon street, comprising the former building of the Trefz Brewing Co.

Newark, N. J.—Plans are being developed for a number of extensions and improvements in the street-lighting system in different parts of the city. Harry R. Jackson, electrical engineer, engaged by the city to make a survey, will soon submit a report and recommendations. It is proposed to remove the flaming arc lamps now used on Broad street, and install modern fixtures. Among the early improvements will be included new lamps on Market street.

Perth Amboy, N. J.—The Board of Aldermen has authorized City Purchasing Agent Martin Olsen to award contracts for equipment for the proposed "white way" lighting system on Madison avenue.

Roosevelt, N. J.—The Borough Council is arranging a new lighting contract with the Public Service Electric Co., providing for a number of improvements in the system, as well as a new commercial line to the East Rahway district.

Allentown, Pa.—The Pennsylvania Power & Light Co. has made application to the Public Service Commission for permission to issue bonds for $8,000,000, the proceeds to be used for financing, operations, extensions and betterments. The company has construction under way on a power plant in this section, and is also making a number of line extensions.

Altoona, Pa.—The Penn Central Light & Power Co. has made application to the Public Service Commission for permission to issue bonds for $625,000, for operations, extensions, improvements, etc.

Farrell, Pa.—Plans have been prepared by F. Whitford Jones, engineer, 1845 Rosalind avenue, Cleveland, for the street lighting on va-

rious streets to cost $30,000. Address John Terpack, president of the council.

Harrisburg, Pa.—The Harrisburg Pipe & Pipe Bending Co. will install new equipment at its power house, including boilers, stokers, and auxiliary apparatus. The installation will be made with a view to eliminating smoke.

NORTH CENTRAL STATES.

Bay Village, O.—A power plant to cost $850,000 will be constructed here by the Northern Ohio Light & Power Co. Address J. H. Case, Eaglecliff, R. D. from Avon Lake.

Lima, O.—An ordinance has passed the council providing for an issue of $20,000 in bonds to pay for boulevard lighting and paving on Main street. Address F. A. Burkhardt, mayor.

Marlette, Mich.—Engineer Hartgering, of Detroit, recommends that two recording watt meters be installed on the main switchboard, one on the power line and one on the lighting line after they are separated. Address the mayor.

Reed City, Mich.—President Haynes of the Osceola Light & Power Co., advised the board of trade that it would be necessary for local capital to be invested in the plant to provide for rebuilding following the breaking of the dam.

Richmond, Ind.—The city plans to sell $58,000 of municipal electric light and power bonds. Address A. Bescher, city comptroller.

Decatur, Ill.—The city plans to install ornamental lamps on Cobb avenue, bids for which were opened April 7. Address city clerk.

Urbana, Ill.—The citizens in the central, western and northwestern portions of the city are in favor of the installation of ornamental lamps. Address Alderman Kirkpatrick.

Milwaukee, Wis.—Engineer T. C. Hatton, City Hall, has prepared plans for the construction of electric power plants to cost $2,000,000. Address J. H. Fowles, secretary, City Hall.

Duluth, Minn.—The city will install a light and power system and erect transmission lines. Address R. H. Hilgedick, Northern States Electric Construction Co., 117 East Second street.

Cedar Valley, Ia.—The Cedar Valley Electric Co. is improving and enlarging its steam plant at a cost of $50,000, and when completed it will give the company double its present capacity.

Clarinda, Ia.—It is planned to erect a municipal electric plant here. Address Dr. C. B. Eller, Clarinda Community Club.

Chanute, Kan.—Plans have been prepared by Lehrach Engineering & Construction Co., 412 American Bank building, Kansas City, Mo., for the erection of a $100,000 power plant for the Ash Grove Lime & Portland Cement Co., whose headquarters are in the Grand Avenue Temple building, Kansas City, Mo.

Kansas City, Mo.—Plans are being perfected for a $3,000,000 enlargement of the Kansas City Power & Light Co.'s new power house at the foot of Brooklyn avenue. The company will spend $1,700,000 in adding to the generating portion of the plant and about $1,300,000 in a boilerroom addition. It is estimated that the building can be enlarged and a new turbogenerator installed by fall, but that the boiler additions cannot be completed before the summer of 1922.

Springfield, Mo.—The Springfield Gas & Electric Co. will construct an electric line from the city limits to the Sunshine school.

Bristow, Okla.—The Oklahoma Gas & Electric Co. is planning extensions and improvements in the local lighting system to cost about $30,000.

Lexington, Okla.—The Town Council has approved a bond issue of $18,000 for the installation of a municipal lighting plant.

Manitou, Okla.—The Town Council has plans under way for the construction of a municipal electric lighting plant. Bonds will be voted.

Muskogee, Okla.—The Muskogee Gas & Electric Co. has plans under way for extensions and improvements in its electric power plant. Line extensions will also be made. The work is estimated to cost $200,000.

Muskogee, Okla.—Plans are under way to construct a power plant to furnish electrical energy to all the principal cities in the state at an estimated cost of $24,000,000. Address R. D. Long.

Fairmont, Neb.—An election was held April 5 to vote on the question of issuing $15,000 bonds to enlarge the electric light plant. Address city clerk.

Osceola, Neb.—An election will be held soon to vote on the question of installing a municipal electric light and ice plant. Address city clerk.

Pottsville, Pa.—The Philadelphia & Reading Coal & Iron Co. has made application to the City Council for the construction of a new pole line in different parts of the municipality for the installation of a telephone system for the use of its employes.

Pittsburgh, Pa.—The Central District Telephone Co. has awarded a contract to the W. T. Grange Construction Co. for the erection of a 3-story telephone exchange building at Highland and Rural avenues, to cost about $340,000.

SOUTH CENTRAL STATES.

Clearwater, Ala.—The Town Council is arranging plans for the installation of an electric power plant and municipal distributing system.

Lothair, Ky.—The Kentucky & West Virginia Power Co. plans to extend its lines through Letcher and Pike counties, where a connection will be made with the Tug River Power Co. Actual construction of these long-distance transmission lines will be undertaken with as little delay as possible.

Memphis, Tenn.—The Memphis Gas & Electric Co., is considering preliminary plans for the erection of a hydroelectric power plant to cost about $2,000,000.

Meridian, Miss.—The City Council is considering the construction of a municipal electric light and power plant, estimated to cost $500,000 with generating and other equipment.

Pascagoula, Miss.—The City Council has awarded a contract to the J. B. McCrary Engineering Co., Atlanta, Ga., for the construction of a municipal electric light and power plant, to be operated in connection with the local waterworks.

Austin, Tex.—The Texas Interurban Railway Co. has been incorporated with a capital of $2,500,000 to construct and operate a system of interurban electric railways between Dallas and Terrell and other Texas cities. It is reported that these several roads are to be built by the General Electric interests. The incorporators of the company are J. F. Strickland, C. E. Calder and C. W. Hobson, all of Dallas, Tex.

Ballinger, Tex.—A special election has been called, April 12, to vote bonds for $65,000 for the construction of a municipal electric light and power plant. The City Commission is in charge.

Dallas, Tex.—The Rigsbee Electric Co. has been incorporated with a capital of $35,000 to operate an electric light and power system in the vicinity of Dallas. A. R. Rigsbee and T. L. Farmer head the company.

Houston, Tex.—Construction of the Houston, Bay Shore and Texas City interurban railway has been started. The proposed line will be 18 mi. long and will run from Houston to Texas City, where it will connect with a ferry service to Galveston. The company was organized several months ago with a capital stock of $300,000. Ed Kennedy is president.

Slaton, Tex.—The Slaton Light Co., recently organized, is planning the operation of a local electric system. Foster Carroll and L. H. Fuller head the company.

Waco, Tex.—Steps are being taken to reorganize the Central Texas Electric Railway Co., which was formed some time ago for the purpose of constructing an interurban electric railway between Waco and Temple, about 35 mi.

WESTERN STATES.

Clovis, N. M.—It is planned to add equipment to the city power plant at a cost of $100,000. Address city clerk.

Colorado Springs, Colo.—The Condon Engineering Co., Harris Trust building, Chicago, has recently taken over the management of the Intermountain Railway, Light & Power Co., and plans to spend $400,000 on improvements.

Livingston, Mont.—The city has petitioned for an ornamental street-lighting system on the west side. Address C. T. Sacket, engineer.

Bonners Ferry, Ida.—Bids were received April 6 for the purchase of $125,000 light, power and city hall bonds. Address city clerk.

Casper, Wyo.—William Kyne has applied for permission to build a cable line from Boysen dam to Casper and construct a power plant at the dam which would supply electric current for street-car service and lights

and power to Casper. The estimated cost of the project is $350,000.

Levan, Utah.—Electric light bonds to the amount of $16,000 have been authorized. Address city clerk.

Ogden, Utah.—The question of issuing municipal light bonds will be submitted to a vote shortly. Address Frank Francis, mayor.

Centralia, Wash.—The city plans to install ornamental lamps in the business section. Address city clerk.

Canby, Ore.—The Oregon Public Service Commission has issued instructions to the Molalla Electric Co. to resume operation of street lamps in the city.

Portland, Ore.—Contracts nearing $250,000 for the construction of a dam, power plant and screen house at the headworks of the Bull Run water reserve will be let this month. Address Fred Randlett, chief engineer of the Water Bureau.

Red Bluff, Cal.—The Pacific Gas & Electric Co. plans to spend $5000 in extending its lines through the Los Molinos colony and bridging a gap for some 4 miles where at present the colonists do not get electric power. Address H. B. Heryford, manager of the West Side Division of the company.

Santa Barbara, Cal.—Engineer J. R. Chapman recommends the development of electric power. It is planned to invest $73,000 in such a project. Address Fred L. Johnston, city manager.

CANADA.

Penticton, B. C.—The City Council plans to spend $30,000 on extensions to the municipal electric light plant.

INCORPORATIONS.

Boston, Mass.—McKenney & Waterbury Co. Capital, $400,000. To manufacture electrical goods and lighting appliances. Incorporators: William A. McKenney, M. W. Vye and Alfred J. Paine.

Boston, Mass.—J. Comer Jones Power & Pump Co. Capital, $20,000. To manufacture pumps and machinery. Incorporators: J. Comer Jones, William E. Fennell, Brookline, Mass., and Harry Fennell, Everett, Mass.

Springfield, Mass.—Auto Electric Ignition Co. Capital, $50,000. Incorporators: John G. Waddell, 497 Belmont avenue, and others.

Rochester, N. Y.—Washerette Corp. Capital, $200,000. To manufacture electrically operated washing machinery. Incorporators: J. J. and T. R. Finucane and H. P. Sickels.

New York, N. Y.—Nesco Electric Service Co. Capital, $75,000. To manufacture electrical apparatus. Incorporators: N. Xenakis, and J. C. Papadopoulos, 2033 Broadway.

New York, N. Y.—H. L. Electric Co. Capital, $10,000. To manufacture electrical equipment. Incorporators: M. L. Wack and O. I. Jubelsohn, 36 East Eighth street.

Enid, Okla.—University Battery & Electric Co. Capital, $100,000.

New York, N. Y.—Auto Heater Corp. Capital, $200,000. Incorporators: W. H. Hawley, E. C. Hawley and J. R. Delafield, 17 East 79th street.

Jersey City, N. J.—Hydroelectro Pyro Co. Capital, $200,000. To manufacture electrical appliances. Incorporators: A. H. Francfort, Angelo Diano and Paul Andrea.

Newark, N. J.—New Jersey Lamp & Brass Co. Capital, $100,000. Incorporators: Ralph Cortese, F. D. Masticci, 185 Market street, and others.

Dayton, O.—Leland Electric Co. Capital, $10,000. Incorporators: G. H. Leland, M. B. Watson and others.

Fremont, O.—Willys Light Home Equipment Co. Capital, $10,000. Incorporators: M. G. Throves, A. J. Vickery and J. L. Patterson.

Fulton, N. Y.—American Fiber Conduit Corp. Capital, $350,000. To manufacture electrical conduits. Incorporators: G. Grossman, G. M. Fanning and R. F. Freeman.

Los Angeles, Cal.—Great News Heating & Appliance Co. Capital, $250,000.

New York, N. Y.—Paramount Lighting Fixtures Corp. Capital, $30,000. To manufacture electric and other fixtures. Incorporators: M. Geringer, H. A. Saflon and J. J. Gans, 302 Broadway.

Brooklyn, N. Y.—The A. M. Co. Capital, $45,000. To manufacture airplane motors, etc. Incorporators: S. I. Muller, 196 Monitor street, W. H. Black and L. Hill.

Milwaukee, Wis.—General Industrial X-Ray Co. Capital, $100,000. To manufacture medical equipment. Incorporators: E. H. Karrer, 246 West Water street, Otto Hermann and William Guilliaume.

Enid, Okla.—University Battery & Electric Co. Capital, $100,000. To manufacture electric storage batteries and other electrical equipment. Incorporators: C. P. Harris, I. F. Conkling and G. E. Darland.

Bryan, Tex.—Automatic Electric Shoe Polishing Machine Co. Capital, $75,000. To manufacture special electrically operated machinery. Incorporators: J. L. Edge, C. A. Harris and J. T. Maloney.

Brooklyn, N. Y.—Lake-Erbe Manufacturing Co. To manufacture electrical equipment. Incorporators: G. G. Erbe and J. Lake, Jr., 1826 14th street.

Newark, N. J.—New Jersey Electric Lamp & Glass Co., 185 Market street. Capital, $100,000.

West New York, N. J.—C. F. Sparling Co. Capital, $100,000. To manufacture motors, etc.

Toronto, Ont.—Electric Phonograph Co. of Canada, Ltd. Capital, $250,000. To manufacture phonographs, etc. Incorporators: Edward A. Richardson, Harold H. Gordon and Hugh Brown.

Toronto, Ont.—Splitdorf Electric Co., Ltd. Capital, $15,000. To manufacture coils, magnetos, spark plugs, etc. Incorporators: Cleland K. Nelson, Stanley S. Mills and Walter B. Kingsmill.

PROPOSALS.

Washington, D. C.—Sealed proposals will be opened April 20 at the office of the Treasury Department, Supervising Architect's office, for a bedside call system in the U. S. Marine Hospital at Boston, in accordance with specifications and drawings, copies of which may be had at the office of the custodian, Boston, or of James A. Wetmore, acting supervising Architect, Washington, D. C.

Washington, D. C.—Sealed proposals will be received up to April 21 by the Treasury Department, Supervising Architect's office, for furnishing wiring materials and certain additional signalling apparatus for the Interior Department offices, Washington, D. C., in accordance with the specifications and bills of quantities attached thereto, copies of which may be obtained at the office of James A. Wetmore, acting supervising architect.

Cincinnati, O.—Bids will be received April 23 for the construction of section No. 4 of the rapid transit system for the city. Address W. A. Geoghegan, secretary of the Board of Rapid Transit Commissioners.

Leitchfield, Ky.—Bids will be received for the purchase of 15 to 30-kw., 3-wire, 120 to 250-volt d-c. generator, belt drive. Address Leitchfield Water Co.

FOREIGN TRADE.

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Supplies (34,561)—A commercial agent in Spain desires to purchase or secure an agency for the sale of electrical supplies and machinery, and marine and construction supplies for shipbuilding, etc. Quotations should be given f. o. b. New York City, or c. i. f. Spanish port. References.

Light Switches, etc. (34,562)—An inquiry has been received by a consul in Rumania for descriptive literature and catalogs for orders on a commission basis of light switches, light brackets, etc., suitable for large apartments houses. Quotations should be given c. i. f. Rumanian port. Catalogs in French or German are preferred, but English will do.

Steam-Heating Supplies, etc. (34,563)—The representative of a firm in Denmark is in the United States and desires to secure agencies from manufacturers for the sale of feed-water heaters, air washers, pumps, etc., and other steam specialties and contractors' equipment. References.

Engines (34,573)—An inquirer in Rumania desires to purchase hot-air engines for small water plants or lighting for houses to be constructed at health resorts and country estates. Quotations should be given c. i. f. Rumanian port. Payment to be in cash. Correspondence should be in French. References.

FINANCIAL NEWS

Comment on the Financial Outlook in the Electrical Industry, New Securities, Reports of Earnings, Dividends and Utility Stocks

Bond Offering of Denver Gas & Electric Light Co.

A new issue of $1,000,000 Denver Gas & Electric Light Co.'s 25-yr. general mortgage 7.5% gold bonds, series "A," is being offered by Bonbright & Co., Chicago, and W. C. Langley & Co., New York City, at 96 and accrued interest, to yield over 7.85%. The Denver Gas & Electric Light Co. supplies electric light, power and gas in the city of Denver, Colo., and its suburbs, serving a population in excess of 260,000, and supplies the business section with steam heat. The proceeds from the sale of these bonds will be used for the purpose of refunding $900,000 total amount of first mortgage 5% bonds of the Lacombe Electric Co., due May 1, 1921, and for other corporate purposes. Net earnings for the year ended Jan. 31, 1921, are over two and one-third times the annual interest charges on the total funded debt outstanding, including these bonds. Approximately 85% of the company's net revenue is derived from the sale of electric current for light and power.

Middle West Utilities Co.'s Earnings.

The Middle West Utilities Co. earned the equivalent of $4.13 a share on the 124,961 outstanding for the 8 mo. ending Dec. 31, making an annual rate of $6.19. Net income for the period was $645,778. The statement is not an annual one because of a change of the fiscal year from April 30 to Dec. 31 because of the absorption in July of the Middle West Securities Co. The surplus after all charges was $516,179, which compares with $475,643 in the full 12 mo. and ended April 30, 1920.

The income account for the 8 mo. shows total income of $1,716,259. Expenses were $215,583 and interest paid $854,626, leaving net income of $645,778. Dividends paid amounted to $73,200, and the dividends accrued totaled $238,301. To the surplus of $334,277 was added $181,902, representing the proportion of subsidiary companies aggregate surplus for the period accruing to the Middle West Utilities Co. bring the total surplus earnings for the 8 mo. up to $516,179.

Mississippi River Power Co. Pays Dividends in Stock.

Directors of the Mississippi River Power Co., for the purpose of adjusting the accumulated dividends of $37.50 a share on the $6,000,000 of outstanding 6% preferred stock, have declared a stock dividend of 37.5%, payable in 6% cumulative preferred stock at par to holders of preferred stock turning in their certificates to be stamped. This issue of additional preferred stock has been approved by the Illinois Public Utilities Commission.

Wellman-Seaver-Morgan Co.

The Wellman-Seaver-Morgan Co., Cleveland, has declared its regular quarterly dividend of 1.75% on its preferred stock, payable April 1 to stockholders of record March 26. Based on an inventory priced as of March 1, 1921, and after ample reservation for contingencies, the company's earnings for 1920, taking into consideration general conditions, are stated to have been satisfactory.

Earnings of Public Service Corp. of New Jersey.

The Public Service Corp. of New Jersey has issued a statement showing a net income for the past year of $2,218,408, or greater by an amount of $1,204,506, as compared with the preceding year of 1919. The gross income of the corporation and its subsidiaries was $72,318,087 in 1920; operating expenses and taxes reduced this by $52,360,894.31. The report sets forth that the electric and gas companies are reasonably prosperous, but that the railway branch of the business is not so satisfactory.

Ohio Power Co.

	1921.	1920.
January gross	$ 641,507	$ 542,441
Net after taxes	153,207	111,787
Total income	243,519	204,884
Surplus after charges	140,039	104,810
Twelve months' gross	6,701,661	5,216,662
Net after taxes	1,425,650	1,520,716
Total income	2,516,101	1,978,133
Surplus after charges	1,279,969	879,135
Balance after preferred dividends	1,110,055	804,590

Adirondack Power & Light Corp.

	1921.	1920.
January gross	$ 433,437	$ 388,293
Net after taxes	166,391	94,034
Surplus after interest charges	91,726	42,912
Twelve months' gross	4,759,670	3,912,375
Net after taxes	1,285,489	1,355,350
Surplus after interest charges	525,544	775,627

Reading Transit & Light Co. and Subsidiaries.

	1921.	1920.
January gross	$ 249,458	$ 243,114
Net after taxes	19,978	29,756
Twelve months' gross	3,032,894	2,678,762
Net after taxes	247,196	400,978

Public Service Corp. of New Jersey and Subsidiaries.

The corporation and subsidiary companies for the year ended Dec. 31, 1920, reports net income, after charges and taxes, was $2,218,408, equivalent, after deduction of preferred dividends, to $5.12 a share earned on the $30,000,000 common stock. This compares with net income of $1,013,902, or $1.81 a share, earned in 1919.

Tennessee Railway Light & Power Co. and Subsidiaries.

	1921.	1920.
January gross	$ 581,262	$ 530,224
Net after taxes	233,994	221,019
12 mo. gross	6,492,049	5,614,978
Net after taxes	2,131,828	2,054,037

Carolina Power & Light Co.

	1921.	1920.
January gross	$ 145,182	$ 127,004
Net after taxes	46,223	34,341
Total income	49,617	36,506
Surplus after charges	32,490	20,304
12 mo. gross	1,616,737	1,279,267
Net after taxes	458,090	403,007
Total income	635,300	563,216
Surplus after charges	424,617	372,983
Balance after preferred dividends	289,255	245,960

General Gas & Electric Co.

The General Gas & Electric Co. for the year ended Dec. 31, 1920, reports gross receipts of $537,594. Net after expenses and taxes was $511,680, from which $400,386 for interest and amortization of bond discount and expense was deducted, leaving a net income for one year of $111,294.

Northern States Power Co.

For the year ended Dec. 31—	1920.	1919.
Gross earnings	$11,798,779	$9,875,934
Net after taxes and maintenance	4,466,938	3,667,313
Bal. after charges	2,318,468	1,493,257
Pref. dividends	1,341,374	1,176,998
Surplus available for depreciation, amortization, common dividends, etc.	977,094	316,259

Dividends.

	Term.	Rate.	Payable
Cent. Ill. Pub. Ser., pfd.	Q	$1.50	Apr. 15
Commonwealth Edison		$2.00	May 2
Duluth Edison El., pfd.	Q	1.5%	Apr. 1
Eastern Tex. El., com.	Q	$2.00	Apr. 1
Erie Lighting, pfd.	Q	1.75%	Apr. 1
Nor. States Pr., pfd.	Q	1.75%	Apr. 20
Ottawa Lt., Ht. & Pr.	Q	1.5%	Apr. 1
Pac. Gas. & El., com.	Q	$1.25	Apr. 15
Puget Sd. Pr. & Lt., pfd.	Q	$0.75	Apr. 15
San Diego Cons. G. & El., pfd.	Q	1.75%	Apr. 15
Washington Water Power	Q	$1.75	Apr. 15
Western States G. & El., pfd.	Q	1.75%	Apr. 15

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid Mar. 29.	Bid Apr. 4.
Adirondack Electric Power of Glenns Falls, common	6	14	10
Adirondack Electric Power of Glenns Falls, preferred	6	71	71
American Gas & Electric of New York, common	..	102	101
American Gas & Electric of New York, preferred	6	37½	37
American Light & Traction of New York, common	..	101	92
American Light & Traction of New York, preferred	6	82	82
American Power & Light of New York, common	4	49	51
American Power & Light of New York, preferred	6	70	70
American Public Utilities of Grand Rapids, common	..	7	7
American Public Utilities of Grand Rapids, preferred	7	17	17
American Telephone & Telegraph of New York	..	100	106
American Water Works & Elec. of New York, common	..	4	4
American Water Works & Elec. of New York, particip	7	7	7
American Water Works & Elec. of New York, 1st preferred	..	44	45
Appalachian Power, common	..	3	3
Appalachian Power, preferred	7	24	25
Cities Service of New York, common	+ extra	250	233
Cities Service of New York, preferred	6	67½	66½
Commonwealth Edison of Chicago	8	107	108
Comm. Power, Railway & Light of Jackson, common	..	13	12½
Comm. Power, Railway & Light of Jackson, preferred	6	34	32
Federal Light & Traction of New York, common	..	6½	6½
Federal Light & Traction of New Yrok, preferred	..	42	43
Northern States Power of Chicago, common	..	47	47
Northern States Power of Chicago, preferred	ex.div.	79	78
Pacific Gas & Electric of San Francisco, common	..	46	46
Public Service of Northern Illinois, Chicago, common	7	75	75
Public Service of Northern Illinois, Chicago, preferred	6	82	82
Standard Gas & Electric of Chicago, common	..	10½	11
Standard Gas & Electric of Chicago, preferred	8	34½	35
Tennessee Railway, Light & Power of Chattanooga, common	..	¾	1
Tennessee Railway, Light Power of Chattanooga, preferred	6	5½	5
Western Power of San Francisco, common	..	24	24
Western Union Telegraph of New York	..	89	90
Industrials—			
Electric Storage Battery of Philadelphia, common	4	97	97
General Electric of Schenectady	8	136	135
Westinghouse Electric & Mfg. of Pittsburgh, common	7	47½	47½